MONTHLY WEATHER REVIEW.

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INTRODUCTION.

The MONTHLY WEATHER REVIEW for January, 1902, is based on reports from about 3,100 stations furnished by employees and voluntary observers, classified as follows: Regular stations of the Weather Bureau, 162; West Indian service stations, 13; special river stations, 132; special rainfall stations, 48; voluntary observers of the Weather Bureau, 2,562; Army post hospital reports, 18; United States Life-Saving Service, 9; Southern Pacific Railway Company, 96; Hawaiian Government Survey, 200; Canadian Meteorological Service, 33; Jamaica Weather Office, 160; Mexican Telegraph Service, 20; Mexican voluntary stations, 7; Mexican Telegraph Company, 3; Costa Rican Service, 7. International simultaneous observations are received from a few stations and used, together with trustworthy newspaper extracts and special reports.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Meteorologist to the Hawaiian Government Survey, Honolulu; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Mr. Maxwell Hall, Government Meteorologist, Kingston, Jamaica; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; Lieut. Commander W. H. H. Southerland, Hydrographer, United States Navy; H. Pittier, Director of the Physico-Geographic Institute, San Jose, Costa Rica; Capt. François S. Chaves, Director of the Meteorological Observatory, Ponta Delgada, St. Michaels, Azores; W. M. Shaw, Esq., Secretary, Meteorological Office, London; and Rev. Josef Algué, S. J., Director, Philippine Weather Service.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to conform generally to the modern international system of standard meridians, one hour apart, beginning with Greenwich. The Hawaiian standard meridian is 157° 30′, or $10^h 30^m$ west of Greenwich. The Costa Rican standard of time is that of San Jose, $0^h 36^m 13^s$ slower than seventy-fifth meridian time, corresponding to $5^h 36^m$ west of Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local standard is mentioned.

Barometric pressures, whether "station pressures" or "sea-level pressures," are now always reduced to standard gravity, so that they express pressure in a standard system of absolute measures.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

During the first three days of the month severe storms prevailed over the British Isles and the eastern part of the Atlantic, with reported minimum barometric pressure, 28.86 inches, at Stornoway, Scotland, on the morning of the 2d. During the 12th a storm of marked intensity moved northeastward over New England, with minimum pressure, 28.90 inches, at Eastport, Me. This storm passed over the Gulf of St. Lawrence and Newfoundland during the 13th, and was met by steamers east and northeast of the Grand Banks during the 14th and 15th, after which it apparently dissipated. The third important storm of the month on the North Atlantic passed north of east off the south Atlantic coast of the United States during the 16th, was central north of Bermuda on the morning of the 17th, and passed northeastward over Newfoundland and the Grand Banks during the 18th. On the morning of the 17th advices regarding this storm were telegraphed in the interest of transatlantic shipping to Atlantic coast ports and to London. During the 22d and 23d a storm of marked strength moved northeastward over New England to the Gulf of St. Lawrence and, passing northeastward over Newfoundland during the 24th, apparently united with an extensive area of low barometer which occupied the Atlantic in high latitudes. On the morning of the 25th the lowest barometer reading of the month, 28.70 inches, was reported at Sumburgh, Scotland. During the night of the 27th a storm passed eastward over Newfoundland. This storm appeared to have a slow progressive movement to the eastward, and by the close of the month the North Atlantic Ocean was covered by an area of low barometer of great magnitude, which extended from the Grand Banks to the British Isles and southward over Azores.

The principal cold wave of January, 1902, occurred during the third decade of the month. This cold wave first appeared over the extreme Northwest British Territory on the morning of the 23d, extended over the middle and northern Rocky Mountain districts by the morning of the 24th, and was reinforced during the 25th by intense cold which attended the advance over the middle west and northwest of an extensive area of high barometer; by the morning of the 26th the line of freezing temperature extended into the interior of southern California, to extreme southern New Mexico, and to central Texas. On the morning of the 27th freezing temperature was reported to the Texas coast, the line of zero temperature reached northwestern Texas, and the thermometer readings were twenty to thirty degrees below zero in the States of the middle and upper Missouri, and Red River of the North valleys. The advance of this cold wave to the south Atlantic coast dis-

tricts was interrupted by an area of low barometer which advanced from the west part of the Gulf of Mexico northeastward during the last three days of the month. Ample warnings of the approach of this cold wave were issued in all districts which it visited. Special warnings telegraphed well in advance of the cold wave throughout the Pacific coast and Rocky Mountain districts prompted precautionary measures which resulted in saving large quantities of perishable products. Heavy snow preceded the advance of this cold wave in many of the districts, concerning which ample warnings were given. On the morning of the 29th snow, melting as it fell, was reported at Riverside, Cal.

BOSTON FORECAST DISTRICT.

The storms of the month were not destructive, as the high winds experienced were offshore or westerly winds. Timely warnings were displayed well in advance of the high winds, and the changes in weather and temperature were, as a rule, accurately forecast.—*J. W. Smith, Forecast Official.*

NEW ORLEANS FORECAST DISTRICT.

Cold-wave warnings were issued for portions of the district on the 3d, 10th, 20th, 23d, 24th, 26th, and 27th. The warnings were generally timely and no cold waves occurred without warnings. No severe windstorms occurred during the month. The daily forecasts have given general satisfaction, and favorable comments on the work of the Bureau are heard on all sides.—*I. M. Cline, Forecast Official.*

CHICAGO FORECAST DISTRICT.

A severe cold wave covered the entire district during the 26th and 27th. Warnings were issued for all points well in advance of its approach. Winter navigation continued on Lake Michigan during the month. Occasional high winds occurred and messages were sent to all open ports, advising vessel interests of the storm. No casualty occurred during the month, except the grounding on the bar near the mouth of the Ludington Harbor of the car ferry *Pere Marquette* on the night of the 13–14th. Navigation was seriously impeded along the west shore of Lake Michigan by extensive fields of ice during the latter part of the month.—*H. J. Cox, Professor.*

DENVER FORECAST DISTRICT.

On the night of the 24th cold-wave warnings were ordered in Utah, western Colorado, and northern New Mexico. On the morning of the 25th cold-wave warnings were given general distribution in Utah and western Colorado, and to points in central and eastern Arizona and southeastern Colorado. A few hours later the following message was given general distribution in Colorado:

Conditions favorable for severe cold and high northerly winds, with heavy snow in mountain districts.

These warnings were issued well in advance of the cold and were fully justified, except in parts of Arizona and New Mexico.—*F. H. Brandenburg, Forecast Official.*

SAN FRANCISCO FORECAST DISTRICT.

The month continued dry, with frost general in California until the 16th, when rain fell from San Francisco northward. The night of the 24th cold-wave warnings were ordered for central and northern California and Nevada. Emergency frost warnings were issued for all points in southern California on the morning of the 25th in ample time to be of service to the orange growers, and emergency frost warnings for southern California were again issued on the morning of the 29th and were verified. Frost warnings were issued on the morning of the 30th. No storms of exceptional severity occurred during the month.—*Alexander G. McAdie, Professor.*

PORTLAND, OREG., FORECAST DISTRICT.

On the morning of the 24th a severe cold wave made its appearance in the British Possessions north of Montana. Special reports showed that the cold wave was moving rapidly toward the district and the following cold-wave warning was at once sent to stations east of the Cascade:

Cold wave. Temperature will fall 20° by morning and zero weather will continue several days,

Storm northeast warnings, containing the additional announcement of much colder weather with snow, were sent to all storm warning display stations. The cold-wave warnings were timely and verified in detail, each station being advised about twenty-four hours in advance of the arrival of the cold wave.—*Edward A. Beals, Forecast Official.*

AREAS OF HIGH AND LOW PRESSURE.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocity.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	1, a. m.	54	114	7, a. m.	47	65	3,450	6.0	575	24.0
II	8, p. m.	41	124	10, a. m.	43	104	1,200	1.5	800	33.3
III	12, a. m.	50	97	15, a. m.	32	65	2,900	3.0	967	40.3
IV	15, a. m.	48	115	16, p. m.	46	78	1,800	1.5	1,200	50.0
V	15, a. m.	43	116	18, p. m.	32	65	3,550	3.5	1,014	42.3
VI	17, a. m.	41	124	21, a. m.	46	60	3,750	4.0	938	39.1
VII	19, p. m.	37	122	23, p. m.	30	82	3,400	4.0	850	35.4
VIII	24, a. m.	54	114	1, p. m. *	46	60	3,775	8.5	444	18.5
Sums							23,825	32.0	6,788	282.9
Mean of 8 paths							2,978		848	35.4
Mean of 32.0 days									746	31.1
I	1, a. m.	51	104	4, a. m.	47	54	2,500	3.0	833	34.7
II	5, p. m.	54	114	7, p. m.	48	86	1,300	2.0	650	27.1
III	7, a. m.	54	114	10, p. m.	48	68	2,600	3.5	743	31.0
IV	10, a. m.	37	87	13, a. m.	49	64	1,950	3.0	650	27.1
	10, p. m.	46	84				1,350	2.5	540	22.5
V	15, p. m.	54	114	20, a. m.	47	54	3,100	4.5	689	28.7
VI	16, a. m.	27	80	17, a. m.	32	65	1,300	1.0	1,300	54.2
VII	16, p. m.	37	114	18, p. m.	32	86	1,700	2.0	850	35.4
VIII	18, a. m.	43	124	23, p. m.	48	63	3,900	5.5	709	29.5
IX	24, a. m.	47	123	26, p. m.	36	87	2,600	2.5	1,040	43.3
X	26, a. m.	47	89	27, a. m.	48	63	900	1.0	900	37.5
Sums							23,200	30.5	8,904	371.0
Mean of 11 paths							2.109		809	33.7
Mean of 30.5 days									761	31.7

*February.

For graphic presentation of the movements of these highs and lows see Charts I and II.—*Geo. E. Hunt, Chief Clerk, Forecast Division.*

RIVERS AND FLOODS.

The stages of the Missouri and upper Mississippi rivers varied but little during the month. The lower Mississippi

was somewhat higher owing to the moderate flood that came out of the Ohio during the early days of the month, its crest passing Cairo, Ill., on the 18th.

The December floods of the Tennessee and the rivers of the Atlantic system subsided rapidly during the early days of the month, although they continued considerably above the danger lines for the first few days, particularly in the lower Tennessee, where the crest did not pass Johnsonville, Tenn., until the 9th and 10th. The flood in the upper Tennessee was particularly severe, in fact the greatest since that of March 2, 1890. The warnings of the Weather Bureau were especially timely, accurate, and comprehensive. Careful attention was given to every detail and as a result property to the value of at least $500,000 was saved. Newspaper comments and testimonials, both written and oral, from those directly interested were unanimous in their commendation of the excellent service rendered. It is true that much property that could not be removed was lost or destroyed and, unfortunately, it is also true that considerable portable property was lost through inattention to the Weather Bureau warnings, which were scattered broadcast.

The heavy snow, sleet, and rain storm of the closing days of the month started another rise in the rivers of the South, and the crests had not yet been reached on the last day.

The ice situation remained practically unchanged, save for a considerable increase in the thickness of the ice at places where the rivers were entirely frozen over, notably in the Red River of the North, the Missouri above the mouth of the Platte, the Mississippi above the mouth of the Illinois, and in the Hudson.

The highest and lowest water, mean stage, and monthly range at 134 river stations are given in Table VII. Hydrographs for typical points on seven principals rivers are shown on Chart V. The stations selected for charting are: Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans on the Mississippi; Cincinnati and Cairo on the Ohio; Nashville on the Cumberland; Johnsonville on the Tennessee; Kansas City on the Missouri; Little Rock on the Arkansas; and Shreveport on the Red.—*H. C. Frankenfield, Forecast Official.*

CLIMATE AND CROP SERVICE.

By James Berry, Chief of Climate and Crop Service Divison.

The following summaries relating to the general weather and crop conditions are furnished by the directors of the respective sections of the Climate and Crop Service of the Weather Bureau:

[Temperature is expressed in degrees Fahrenheit and precipitation in inches and hundredths.]

Alabama.—The mean temperature was 43.4°, or 1.4° below normal; the highest was 76°, at Healing Springs on the 3d and at Daphne on the 26th, and the lowest, 10°, at Oneonta on the 14th. The average precipitation was 3.86, or 1.06 below normal; the greatest monthly amount, 7.60, occurred at Clanton, and the least, 1.32, at Eufaula.

First half of month, quite cold and dry; latter half, generally rainy and unfavorable for preparatory farm work, which is generally backward. Late reports confirm previous estimates that the greater portion of the fall sown oats were killed by the severe cold in December.—*F. P. Chaffee.*

Arizona.—The mean temperature was 46.2°, or 1.2° above normal; the highest was 86°, at Champies Camp on the 3d, and the lowest, 12° below zero, at Flagstaff on the 26th and at Fort Defiance on the 27th. The average precipitation was 0.85, or 0.31 below normal; the greatest monthly amount, 3.17, occurred at Flagstaff, while none fell at Benson.

Some plowing and seeding were done during the month, the January rains putting the soil in fair condition. On account of the great scarcity of water for irrigation, a greatly decreased acreage is under cultivation as compared with previous years.—*Wm. G. Burns.*

Arkansas.—The mean temperature was 38.0°, or 2.6° below normal; the highest was 79°, at Beebranch on the 9th, and the lowest, 2°, at Dutton on the 26th and at Fayetteville, Oregon, Pond, and Winslow on the 27th. The average precipitation was 4.13, or 0.17 below normal; the greatest monthly amount, 8.51, occurred at Pinebluff, and the least, 0.96, at Fayetteville.

On account of the long continued drought of last summer the ground was so hard and dry that fall plowing was greatly delayed and much proposed work was finally abandoned. Seeding was also delayed, and on account of the unfavorable condition of the soil much grain was not sown at all. Some seed that was scattered broadcast upon hard ground never sprouted; the drilled seed, however, has given better results. Late fall showers benefited the late sown more than the early sown seed. There being no protection by snow, wheat, oats, and rye were badly injured by the freeze in December; wheat has made very little growth since and the stand is poor generally; oats are very poor, and, in many instances, are reported as being entirely killed. Farm work is either very much retarded or is entirely abandoned. Some plowing for corn has been done, but very little.—*Edward B. Richards.*

California.—The mean temperature was 44.5°, or 0.3° below normal; the highest was 96°, at Anaheim on the 5th, and the lowest, 20° below zero, at Truckee on the 25th. The average precipitation was 1.38, or 3.17 below normal, the greatest monthly amount, 8.17, occurred at Cuyamaca, while none fell at Hornbrook and Mammoth Tank.

Conditions during the month were generally unfavorable for crops. The temperature was below normal, and severe frosts were frequent. The precipitation was much below the average in all parts of the State. Grain made slow growth, but was not seriously damaged by frost, and green feed became scarce in many places. Oranges in southern California were considerably injured by frost.—*Alexander G. McAdie.*

Colorado.—The mean temperature was 26.1°, or 1.4° above normal; the highest was 74°, at Blaine on the 8th, and the lowest, 31° below zero, at Fort Collins on the 26th. The average precipitation was 0.42, or 0.34 below normal; the greatest monthly amount, 2.60, occurred at Ruby, and the least, trace, at Cheyenne Wells, Fort Morgan, and Seibert.

The snowfall in the mountains was below normal, thus adding to the deficiency already noted for the preceding three months. The old snow is practically solid ice, and high winds have swept the new snow from exposed localities into ravines, gulches and drifts, so that, on the whole, conditions are favorable for its conservation until late in the season.—*F. H. Brandenburg.*

Cuba.—The mean temperature was 67.7°; the highest was 90°, at San Cayetano on the 26th, and the lowest, 40°, at San Cayetano on the 13th and 15th. The average precipitation was 1.27; the greatest monthly amount, 7.49, occurred at Havana, and the least, 0.19, at Pinar del Rio.

The precipitation, which with a few exceptions was unseasonably light, practically all occurred from the 3d to 6th, inclusive, and on the 16th. During the greater portion of the month the temperature continued abnormally low, and the nights were, as a rule, unusually cool. The long prevalence of dry weather proved very disastrous to tobacco not irrigated, and in all the tobacco districts the first cutting gave unusually discouraging yields which were mostly of a poor quality. Spring and fall planted canes suffered greatly from lack of moisture; their development was retarded, and in some sections spring canes dried badly. The dry, cool weather was, however, favorable for the cane harvest, and grinding progressed steadily; throughout the month cane juice density was high. Small crops are extremely scarce in Pinar del Rio; while not abundant elsewhere they are generally sufficient for local needs.—*W. B. Stockman.*

Florida.—The mean temperature was 55.1°, or 2.3° below normal; the highest was 89°, at Bartow on the 28th and 31st and at Gainesville on the 30th, and the lowest, 15°, at Sumner on the 12th and Middleburg on the 13th. The average precipitation was 0.65, or 1.88 below normal; the greatest monthly amount, 3.26, occurred at Bonifay, while none fell at Miami, Rockwell, and St. Augustine.

The month was characterized by low temperatures, much sunshine, and deficient precipitation. As a consequence the growth of vegetables was retarded, and seeding and transplanting were delayed. Numerous frosts, particularly those of the 13th and 14th, did considerable damage to tender vegetables, the recent growth of citrus trees, and the bloom of the strawberry. The absence of rain contributed very materially to the backward state of work and to the scarcity of truck. The bulk of the orange crop was shipped during the month. Citrus trees and pineapples have withstood the weather nicely, and are now in good condition. Considerable cane and cassava have been planted, and land is being prepared for cotton and corn. Peach trees are in bloom; orange buds are swelling.—*A. J. Mitchell.*

Georgia.—The mean temperature was 43.9°, or 1.4° below normal; the highest was 82°, at Waverly on the 27th, and the lowest, 7°, at Greenbush on the 13th. The average precipitation was 1.81, or 2.38 below normal; the greatest monthly amount, 4.27, occurred at Point Peter, and the least, trace, at Millen.

The average precipitation was the lowest on record for January during the past eleven years. Practically none occurred during the first half of the month, and the bulk occurred during the latter part of the

last decade. The precipitation was deficient at all stations, and notably so in the southern section, where the totals were under one inch. The largest amounts were recorded in Hart and Oglethorpe counties. Much freezing weather prevailed. This was beneficial to the fruit crop by preventing the flow of sap, but was injurious to fall and winter wheat and oats, large areas of which were killed.—*J. B. Marbury.*

Idaho.—The mean temperature was 22.9°, or 1.4° below normal; the highest was 61°, at Paris on the 1st, and the lowest, 34° below zero, at Lake on the 25th. The average precipitation was 0.79, or 0.91 below normal; the greatest monthly amount, 1.90, occurred at Lakeview and Murray, and the least, 0.07, at Lost River.

January was remarkable for mildness in all parts of the State from the 1st to 23d. On the 24th a cold wave extended to all sections, lowering the temperature many degrees below zero, even in the protected valley sections. It was preceded by snow over the western part of the State, and continued unabated for the remainder of the month. Stock fared well during the severe weather and no losses have been reported. Fall sown wheat has suffered severely for want of snow protection. The snowfalls were unusually light over the wheat-growing sections and mountain districts. The outlook is for a waterflow below the average during the crop season of 1902.—*S. M. Blandford.*

Illinois.—The mean temperature was 27.2°, or 0.7° above normal; the highest was 68°, at Equality on the 9th, and the lowest, 24° below zero, at Lanark on the 28th. The average precipitation was 1.00, or 1.24 below normal; the greatest monthly amount, 3.56, occurred at Raum, and the least, 0.30, at Monmouth.

Very dry weather prevailed during the first two decades of January, but on the 20th-21st a storm crossed the State and caused a moderately heavy snowfall, which was augmented by later snows, and the end of the month found the greater part of the State covered with snow to a considerable depth. Moderate temperatures prevailed during the dry weather, but the latter part of the month witnessed some very cold weather. Winter wheat was damaged considerably by the dry weather, but the snow of the latter part of the month served the double purpose of protecting it from the severe cold and of furnishing much needed moisture, and it is believed that the crop has been considerably benefited.—*M. E. Blystone.*

Indiana.—The mean temperature was 28.4°, or 2.0° below normal; the highest was 67°, at Crawfordsville on the 1st, and the lowest, 12° below zero, at Hammond on the 28th. The average precipitation was 1.41, or 1.42 below normal; the greatest monthly amount, 4.48, occurred at Jeffersonville, and the least, 0.20, at Hector.

Dry and comparatively mild weather prevailed up to about the 20th, and wheat and fall sown grasses are believed to have suffered seriously. Wheat was short, looked brown and dry, and it was believed that in many fields the roots were dead. During the last decade of the month, rain, sleet, and snow, with temperature generally below freezing, prevailed.—*W. T. Blythe.*

Iowa.—The mean temperature was 22.4°, or 5.3° above normal; the highest was 63°, at Pella, St. Charles, and Thurman on the 1st, and the lowest, 31° below zero, at Atlantic on the 27th. The average precipitation was 0.88, or 0.34 below normal; the greatest monthly amount, 2.83, occurred at Ridgeway, and the least, 0.19, at Mount Pleasant.

The month was generally dry and warmer than usual, with much more than normal amount of fair weather. Conditions were favorable for stock feeding and general winter operations. Winter grains and grasses were afforded protection by light snow during prevalence of low temperature.—*John R. Sage.*

Kansas.—The mean temperature was 30.2°, or 1.3° above normal; the highest was 75°, at Englewood on the 9th, and the lowest, 22° below zero, at Frankfort and Harrison on the 27th. The average precipitation was 0.86, or 0.09 above normal; the greatest monthly amount, 2.31, occurred at Ellinwood, and the least, 0.15, at Leoti and Ulysses.

The warm, dry weather of the first three weeks permitted plowing in southern counties, and was very favorable for stock. Feed abundant. Wheat not pastured too closely continued in good condition, and during the cold of the last ten days was well covered with 2 to 6 inches of snow.—*T. B. Jennings.*

Kentucky.—The mean temperature was 33.7°, or 1.6° below normal; the highest was 70°, at Marrowbone on the 10th, and the lowest, 5°, at Owenton on the 27th. The average precipitation was 5.14, or 0.73 above normal; the greatest monthly amount, 8.25, occurred at Bowling Green, and the least, 2.95, at Scott.

The condition of wheat during the month was far from satisfactory. The cold, dry weather of December and the continued dry weather during the first two weeks of January were very unfavorable to it; at the close of the month it was covered by sleet and snow, and what effect this will have is uncertain. The sleet of the 28th to 30th wrought very great damage to fruit and shade trees. Tobacco beds were burned and prepared in some localities.—*H. B. Hersey.*

Louisiana.—The mean temperature was 48.4°, or 2.3° below normal; the highest was 84°, at Lake Providence on the 2d, and the lowest, 10°, at Robeline on the 27th and at Lake Providence on the 30th. The average precipitation was 1.84, or 3.10 below normal; the greatest monthly amount, 4.51, occurred at Plain Dealing, and the least, 0.13, at Southern University Farm.

Preparations for corn and cotton planting are well advanced over the southern portion of the State, while over the northern portion the cold weather which prevailed during the greater portion of the month interfered with outdoor work, and preparations for crops are much behind. Plowing for spring planting of sugar cane is generally completed; planting is well advanced, and is completed in some localities. The condition of seed and stubble cane is generally good, although a few correspondents report the condition of stubble cane doubtful. It now appears to be the intention to seed all available land to rice, and preparations are progressing rapidly. Truck gardens are being planted in the coast parishes and germination is generally satisfactory.—*I. M. Cline.*

Maryland and Delaware.—The mean temperature was 29.9°, or 2.2° below normal; the highest was 64°, at Millsboro, Del., on the 28th, and the lowest, 7° below zero, at Deer Park, Md., and Sunnyside, Md., on the 5th. The average precipitation was 3.52, or 0.53 above normal; the greatest monthly amount, 6.75, occurred at Sunnyside, Md., and the least, 1.80, at Denton, Md.

The deficiency in temperature was produced by extended, rather than severe, periods of cold weather. Alternate freezes and thaws prevailed during the greater part of the month. The supply of moisture received was well distributed as to area, but the larger part by far was received during the final decade. Heavy rains fell on the 21st-22d, moderate amounts from the 25th to 27th, and a general snowstorm accompanied at times by rain and sleet began on th[illegible]th and lasted through the remainder of the month. Wheat and grasses were in poor condition, except that in extreme western Maryland the winter growth is good on account of ample snow protection; there are also some fields of early sown wheat elsewhere that are in a fair state of growth. The crop as a whole, however, is much below average condition. The general snow covering at the close of the month, which was the first to be recorded this winter, is a very favorable feature, and considerable benefit is expected to result.—*Oliver L. Fassig.*

Michigan.—The mean temperature was 21.4°, or about normal; the highest was 52°, at Coldwater on the 8th, and the lowest, 31° below zero, at Humboldt on the 28th. The average precipitation was 0.78, or 1.57 below normal; the greatest monthly amount, 3.44, occurred at Calumet, and the least, 0.08, at Bay City.

The month was very dry, and in the winter wheat counties most of the December snow had blown away and evaporated, leaving many fields nearly bare. Very little or practically no alternate freezing and thawing had occurred, but quite a number of correspondents fear that the bare condition of the ground and the cold wave of the 27th to 30th has done some damage to winter wheat. Although it is impossible to make any definite statement regarding the present condition of winter wheat, most correspondents say that they do not believe it has suffered very much.—*C. F. Schneider.*

Minnesota.—The mean temperature was 15.9°, or 5.0° above normal; the highest was 59°, at Beardsley and Lynd on the 8th, and the lowest, 50° below zero, at Pokegema Falls on the 28th. The average precipitation was 0.44, or 0.30 below normal; the greatest monthly amount, 0.92, occurred at Caledonia, and the least, 0.10, at Beardsley, Hallock, and Warroad.

The precipitation was all snow, and most of it fell on the 25th, 26th, and 30th. Snow covered all the State for the entire month, except a small portion along the western border south of Big Stone Lake. The depth varied from a trace to 9 inches in prairie regions, and was probably greater in the timber. The continued fair weather and moderate cold of the month were very favorable for the logging interests. The ice roads were easily kept in order, and there was not too much snow. No work in the soil possible.—*T. S. Outram.*

Mississippi.—The mean temperature was 43.9°, or 2.9° below normal; the highest was 78°, at Magnolia on the 26th, and the lowest, 14°, at University on the 13th. The average precipitation was 3.45, or 2.00 below normal; the greatest monthly amount, 6.45, occurred at Water Valley, and the least, 0.93, at Bay St. Louis.

Excepting light precipitation on the 4th and 5th the first seventeen days of the month were unusually pleasant. From the 18th to the close of the month generally cloudy weather obtained with precipitation at frequent intervals from the 25th to the 31st inclusive. From one to two inches of sleet fell in the northern counties on the 27th and 28th.—*W. S. Belden.*

Missouri.—The mean temperature was 30.1°, or about normal; the highest was 72°, at Dean and Potosi on the 9th, and the lowest, 17° below zero, at Sublett and Windsor on the 27th. The average precipitation was 1.25, or 0.87 below normal; the greatest monthly amount, 6.31, occurred at Gayoso, and the least, 0.28, at Sarcoxie.

During the first nineteen days of the month there was practically a total absence of precipitation, and the ground being bare, wheat suffered to some extent from both drought and freezing. As a rule, however, the damage was not great, except in a few of the central, northeastern, and southern counties, where a part of the crop was reported in a very unpromising condition. During the last ten days of the month frequent snows afforded ample protection, except in portions of the southern sections, where the precipitation was in the form of rain and sleet, which covered the fields with a coating of ice. In the central and southern sections considerable plowing was done during the early part of the month.—*A. E. Hackett.*

Montana.—The mean temperature was 21.0°, or 0.9° above normal; the highest was 67°, at Bigtimber on the 9th, and the lowest, 45° below zero, at Ovando on the 27th. The average precipitation was 0.34, or 0.49 below normal; the greatest monthly amount, 2.17, occurred at Troy, while none fell at Chester, Fort Logan, and Deer Lodge.

The temperature was above the freezing point at every station during the afternoons from the 1st to the 18th. On the 23d a cold wave passed over the entire State, and during the last seven days cold weather prevailed.—*E. J. Glass.*

Nebraska.—The mean temperature was 24.8°, or 4.1° above normal; the highest was 70°, at Arcadia on the 8th, and the lowest, 39° below zero, at Loup on the 25th. The average precipitation was 0.64, or 0.03 above normal; the greatest monthly amount, 1.60, occurred at Hartington, and the least, 0.15, at Gering.

The dry weather during the first part of the month was unfavorable for wheat, but a good snow preceded the cold period the last week of the month and was very beneficial. The snow drifted considerably in the western portion of the winter wheat district, making it less beneficial. In the eastern part of the State the snow remained quite uniformly distributed over the ground. Wheat generally damaged but little, if any, and continues in promising condition.—*G. A. Loveland.*

Nevada.—The mean temperature was 28.2°, or about normal; the highest was 69°, at Candelaria on the 5th, and the lowest, 32° below zero, at Potts on the 29th. The average precipitation was 0.51, or 0.85 below normal; the greatest monthly amount, 1.57, occurred at Hamilton, and the least, trace, at Hot Springs, Silver Peak, and Sodaville.

The weather during the first and second decades was moderately warm and generally clear; the last decade was unusually cold and more or less stormy. An excellent crop of thick, clear ice was harvested the latter part of the month. The weather throughout the month was very favorable to stock interests.—*J. H. Smith.*

New England.—The mean temperature was 21.1°, or 0.6° below normal; the highest was 56°, at Lewiston, Me., on the 22d, and the lowest, 20° below zero, at Berlin Mills, N. H., and Woodstock, Vt., on the 20th. The average precipitation was 2.40, or 1.48 below normal; the greatest monthly amount, 5.88, occurred at Chatham, N. H., and the least, 0.66, at Burlington, Vt.

The weather of the month was uneventful. The temperature was about normal, but the precipitation was deficient in nearly all sections. The weather conditions were very favorable to the ice harvest and to outdoor work in general.—*J. W. Smith.*

New Jersey.—The mean temperature was 28.4°, or 1.5° below normal; the highest was 58°, at Flemington on the 22d, and the lowest, 5° below zero, at Layton on the 31st. The average precipitation was 3.28, or 0.38 below normal; the greatest monthly amount, 4.35, occurred at Charlotteburg, and the least, 2.52, at Asbury Park.

The ground was frozen during the entire month; there was no thawing, and consequently no injury to winter grain or young grasses. There was no snow on the ground from 12th to 28th. Moderately heavy snow fell during the last three days, covering the ground to the depth of 4 inches.—*Edward W. McGann.*

New Mexico.—The mean temperature was 35.7°, or 2.1° above normal; the highest was 81°, at Carlsbad on the 2d, and the lowest, 12° below zero, at Bluewater on the 27th. The average precipitation was 0.42, or 0.07 below normal; the greatest monthly amount, 1.95, occurred at Fort Wingate, while none fell at Cambray, Engle, and Gage, and only a trace at Alamogordo, Deming, Las Vegas, Hot Springs, Lordsburg, and San Marcial.

Warm, dry, and unusually pleasant for the season. Stock ranges suffering from drought until the last week of the month.—*R. M. Hardinge.*

New York.—The mean temperature was 20.7°, or 1.8° below normal; the highest was 51°, at Franklinville on the 3d and at Albany, Port Jervis, and Setauket on the 22d, and the lowest, 24° below zero, at Canton on the 17th. The average precipitation was 2.09, or 0.68 below normal; the greatest monthly amount, 4.57, occurred at Mayle, and the least, 0.54, at Rome.

Lack of snow protection and some winter killing of wheat by formation of ice on low lands were reported in parts of the southeast section, but ample protection obtained throughout month in other sections, and wheat, rye, grasses, and fruit trees were reported in good condition.—*R. G. Allen.*

North Carolina.—The mean temperature was 38.2°, or 2.0° below normal; the highest was 75°, at Goldsboro and Moncure on the 10th and at Sloan and Wilmington on the 27th, and the lowest, 5°, at Linville on the 4th. The average precipitation was 2.37, or 1.82 below normal; the greatest monthly amount, 4.47, occurred at Highlands, and the least, 1.01, at Kingston.

Weather conditions were very unfavorable for winter wheat, oats, and rye, chiefly, however, because most of the winter grains were seeded very late. Early sown wheat was checked in growth, and spreading was prevented, by drought during the first two decades, and at the end of January it was just showing green. Late sown wheat was caught by freezing weather soon after sprouting and much of it was winter killed; fall oats suffered in the same way, but rye was not greatly injured. At the close of the month stands of winter wheat and oats were very poor, and the prospects far from favorable. The cold rain, sleet, snow, fog, and gloomy skies during the last week of January made the weather extremely disagreeable, but the moisture was very essential for the winter crops, which were benefited thereby, although the snowfall was insufficient for a protective covering.—*C. F. von Herrmann.*

North Dakota.—The mean temperature was 12.7°, or 6.0° above normal; the highest was 51°, at Fort Yates on the 9th, and the lowest, 40° below zero, at Cando on the 27th. The average precipitation was 0.14, or 0.29 below normal; the greatest monthly amount, 0.80, occurred at Portal, and the least, trace, at Ashley, Coal Harbor, Cando, Devils Lake, Dunseith, Falconer, Glenullin, Melville, Minot, New England City, Steele, and Willow City.

The month was generally favorable for stock raising, the comparatively mild weather and light snowfall allowing stock to pasture on the ranges most of the month.—*B. H. Bronson.*

Ohio.—The mean temperature was 27.3°, or 0.9° below normal; the highest was 63°, at Portsmouth on the 9th, and the lowest, 11° below zero, at Orangeville on the 14th. The average precipitation was 1.42, or 1.44 below normal; the greatest monthly amount, 5.03, occurred at Thurman, and the least, 0.28, at Lima.

The deficiency in temperature throughout the State increased toward the south. The lowest temperatures generally occurred on the 28th, and highest on 2d and 9th. Precipitation was deficient, except in extreme southeast, and decreased toward the northwest. With the exception of that on the 26th and 27th, it occurred mostly in the form of snow. The condition of wheat was less promising than at the end of December. The plants were small, many report injury by freezing and thawing where snow covering was lacking, and dry weather was unfavorable. Fields were covered with snow at the end of the month. The buds of tender varieties of peaches suffered injury by freezing.—*J. Warren Smith.*

Oklahoma and Indian Territories.—The mean temperature was 37.4°, or about normal; the highest was 75°, at Kingfisher on the 8th and at Hennessey on the 9th, and the lowest, 10° below zero, at Fort Reno on the 27th. The average precipitation was 0.61, or 0.60 below normal; the greatest monthly amount, 1.60, occurred at Hartshorne, Ind. T., and the least, 0.02, at Ryan, Ind. T., and Fort Sill, Okla.

Precipitation continued insufficient, and wheat and oats are in very poor condition and suffering for moisture; over some counties wheat is reported as nearly beyond help, and will be reduced decidedly in amount, even if sufficient precipitation occurs from now on; the condition is most serious over the western and southern portions of Oklahoma, and the Chickasaw Nation of the Indian Territory; over the northern portion of the section wheat may still make a fair crop. Stock is doing well; fruit is uninjured; spring plowing is in progress, but hindered by hard, dry ground.—*C. M. Strong.*

Oregon.—The mean temperature was 35.7°, or 0.5° below normal; the highest was 74°, at Prineville on the 9th, and the lowest, 27° below zero, at Pine on the 29th. The average precipitation was 3.07, or 2.87 below normal; the greatest monthly amount, 8.64, occurred at Falls City, and the least, trace, at Klamath Falls.

The month was very dry in all parts of the State. From the 25th to the close of the month it was unseasonably cold, with freezing temperatures west of the Cascade Mountains to the coast line and with zero weather generally in eastern Oregon. Winter wheat and oats in the Willamette Valley were well protected by snow, and are reported to be in excellent condition. In eastern Oregon the snowfall was light and drifted badly, and where grain was unprotected the damage will be considerable.—*Edward A. Beals.*

Pennsylvania.—The mean temperature was 25.6°, or 2.0° below normal; the highest was 58°, at Westtown, on the 22d, and the lowest, 13° below zero, at Dyberry on the 20th. The average precipitation was 2.80, or 0.42 below normal; the greatest monthly amount, 5.15, occurred at Somerset, and the least, 1.00, at Davis Island Dam.

In the northern and western counties wheat and rye were fairly well protected by snow, and received no apparent harm from freezing. In other sections of the State snow protection was insufficient, and grain suffered from frosts, washouts, floods, and heavy rains.—*T. F. Townsend.*

Porto Rico.—The mean temperature was 74.0°, or slightly below normal; the highest was 92°, at Coloso, Arecibo, Manati, and Las Marias, and the lowest, 52°, at Adjuntas. The average precipitation was 7.83, or nearly 4.00 above normal; the greatest monthly amount, 14.10, occurred at Caguas, and the least, 0.94, at Juana Diaz.

Weather generally favorable for growing crops, but too wet for the maturing canes. Heavy rains on 19th and 20th damaged small crops and young tobacco along the rivers; they also delayed field work. Cane grinding quite general; the grade of juice is fair considering the unfavorable conditions prevailing during the maturing season. Some indications of improvement in the juice at end of month. Young canes doing well; coffee trees budding, those on the high lands being in blossom; some tobacco planted during the month and the young plants doing well, especially the November planting; good oranges abundant, but the minor fruits and vegetables generally scarce, excepting, perhaps, yams and ganduras. New crop of vegetables ready for the markets. Pastures good and stock doing well.—*E. C. Thompson.*

South Carolina.—The mean temperature was 42.4°, or 2.4° below normal; the highest was 80°, at Conway and Gillisonville on the 27th, and

the lowest, 11°, at Temperance on the 4th. The average precipitation was 2.05, or 1.43 below normal; the greatest monthly amount, 4.18, occurred at Longshore, and the least, 0.36, at Blackville.

There were a number of ground freezes over the central and western portions that winter-killed some oats. Plowing and other preparations for spring planting and gardening progressed rapidly over the eastern, and slowly over the western counties. The oat and wheat crops are in poor condition, but reseeding is being done to a large extent.—*J. W. Bauer.*

South Dakota.—The mean temperature was 20.1°, or 4.0° above normal; the highest was 65°, at Rapid City on the 7th and at Fort Meade on the 8th, and the lowest, 32° below zero, at Elk Point on the 27th. The average precipitation was 0.33, or 0.22 below normal; the greatest monthly amount, 1.53, occurred at Fort Meade, and the least, trace, at Cherry Creek and Mound City.

Almost continuous fair weather prevailed during the first and second decades, with generally moderate temperature for the season. Live stock subsisted largely on the ground-cured range grasses, resulting in considerable economy of garnered and stacked feed. The weather during the third decade was cold, with the temperature much of the time near or below zero, and snow at intervals, necessitating some feeding of stock on farms and on ranges of limited area. From some western localities a slight loss of young, unacclimated cattle is reported, due to the low temperature. An unusual feature of the cold weather was the occurrence in the extreme southeastern county of the minimum temperature of the month for the State.—*S. W. Glenn.*

Tennessee.—The mean temperature was 36.9°, or 1.3° below normal; the highest was 73°, at Ashwood on the 1st and at Hohenwald on the 27th, and the lowest, 2°, at Silver Lake on the 14th. The average precipitation was 5.14, or 0.13 above normal; the greatest monthly amount, 7.83, occurred at Covington, and the least, 2.77, at Bristol.

Alternate freezing and thawing, following mild weather, with no snow protection, caused very bad condition in winter grains, and at the end of the month prospects were poorer than for many years. Early sown and drilled grain are better than late sowings; much of the latter appears dead, and considerable of the area devoted to this portion of the crop will be plowed up and planted in corn. Winter oats seem to be mostly killed.—*H. C. Bate.*

Texas.—The mean temperature was 46.4°, or 0.7° below normal; the highest was 91°, at Trinity on the 4th, and the lowest, 4° below zero, at Amarillo on the 26th. The average precipitation was 0.89, or 1.60 below normal; the greatest monthly amount, 2.95, occurred at Texarkana, while none fell at Kopperl.

The month was highly favorable for outdoor work and farming operations progressed with but few interruptions. Along the northeastern border of the State and over portions of the Gulf coast sufficient rainfall was received for the growth of crops, but over the larger part of the State the need of moisture continues to be felt. The growth of winter wheat was checked by the unfavorable weather conditions and poor stands were general. The oat crop was seriously affected and there was little of this crop that showed life. Truck crops, and especially strawberries, were exceptionally well advanced and suffered little from the cold wave that prevailed during the last decade of the month.—*Edward H. Bowie.*

Utah.—The mean temperature was 26.5°, or 0.8° above normal; the highest was 74°, at Fillmore on the 8th, and the lowest, 38° below zero, at Woodruff on the 26th. The average precipitation was 0.71, or 0.33 below normal; the greatest monthly amount, 2.41, occurred at Ranch, and the least, trace, at Giles and Terrace.

In many localities fall grain had no covering of snow when the low temperatures of the latter part of the month occurred, and in some cases the crop has been slightly damaged. The snow has improved conditions on the ranges and all kinds of stock are generally doing well.—*L. H. Murdoch.*

Virginia.—The mean temperature was 34.5°, or 2.5° below normal; the highest was 69°, at Petersburg on the 11th, and the lowest, 3°, at Stanardsville on the 31st. The average precipitation was 2.88, or 0.30 below normal; the greatest monthly amount, 4.78, occurred at Bigstone Gap, and the least, 1.72, at Bedford City.

The month was a most unfavorable one for all winter crops, the weather being cold and dry, and there being no adequate snow protection. Freezing and thawing in the fields were frequent, heaving the young sprouts of wheat, oats, and clover out of the ground, and causing winter-killing. Early and late seeding suffered, especially the latter.—*Edward A. Evans.*

Washington.—The mean temperature was 32.7°, or 1.0° below normal; the highest was 68°, at Mottingers Ranch on the 7th, and the lowest, 22° below zero, at Northport on the 27th. The average precipitation was 3.55, or 1.05 below normal; the greatest monthly amount, 9.95, occurred at Clearwater, and the least, 0.42, at Moxee.

The mild weather of the first three weeks was favorable to growth. A heavy snowstorm on the 24th covered wheat fields with snow, but many fields were blown bare by violent winds, and wheat was probably frozen out by the severe weather that ensued.—*G. N. Salisbury.*

West Virginia.—The mean temperature was 30.2°, or 1.8° below normal; the highest was 64°, at Williamson on the 9th, and the lowest, 1° below zero, at Parsons and Terra Alta on the 5th. The average precipitation was 3.65, or 0.45 above normal; the greatest monthly amount, 8.52, occurred at Lewisburg, and the least, 1.45, at Moscow.

Alternate freezing and thawing, with practically no snow protection, were very unfavorable for wheat, which was already in a weak condition from the fall drought, and it is feared considerable has been winter-killed; practically no plowing for corn or farm work of any kind has been done on account of frozen ground. The sleet storm of the 29th and 30th was reported to have been the worst in a number of years (some say since 1856) and considerable damage was done, especially to fruit trees, by breaking off limbs. The sleet was very heavy, in some cases being three-quarters of an inch thick.—*E. C. Vose.*

Wisconsin.—The mean temperature was 18.6°, or 4.2° above normal; the highest was 56°, at Valley Junction on the 8th, and the lowest, 39° below zero, at Hayward on the 28th. The average precipitation was 0.68, or 0.74 below normal; the greatest monthly amount, 1.95, occurred at Ladysmith, and the least, 0.07, at Port Washington.

Winter crops were generally well protected throughout the month, although during the second decade much of the ground in the southeastern counties was bare. From the 20th to the 26th snow occurred at intervals, so that the ground was well covered before the cold wave of the 28th.—*W. M. Wilson.*

Wyoming.—The mean temperature was 20.7°, or 1.4° below normal; the highest was 65°, at Fort Laramie on the 8th, and the lowest, 41° below zero, at Griggs on the 26th. The average precipitation was 0.26, or 0.36 below normal; the greatest monthly amount, 0.96, occurred at Fort Yellowstone, and the least, trace, at Buffalo, Burlington, Laramie, Lovell, and South Pass City.

Unusually mild and pleasant weather was general over the State during the first two decades of the month. A severe cold wave overspread the State after the 22d, culminating on the 26th in the severest cold wave of the winter. The snowfall for the month was light, and the supply of snow in mountains was not materially increased. Stock suffered some during the cold wave, but no losses were reported.—*W. S. Palmer.*

SPECIAL CONTRIBUTIONS.

HAWAIIAN CLIMATOLOGICAL DATA.

By CURTIS J. LYONS, Territorial Meteorologist.

GENERAL SUMMARY FOR JANUARY, 1902.

Temperature mean for the month, 70.8°; normal, 70.1°; average daily maximum, 76.5°; average daily minimum, 65.6°; average daily range, 10.9°; greatest daily range, 20.5°; least daily range, 5°; highest temperature, 78°; lowest, 55.5°.

Barometer average, 29.995; normal, 29.950 (corrected for gravity by —.06); highest, 30.17, on the 1st; lowest 29.79, on the 24th; greatest 24-hour change, i. e., from any given hour on one day to the same hour on the next, 0.13. Lows passed this point on the 9th and 24th; highs on the 1st and 16th.

Relative humidity, 72 per cent; normal, 76.7; mean dew-point, 60.7°; normal, 62.8°; absolute moisture, 5.89 grains to the cubic foot; normal, 6.27. Lowest dew-point, 10th and 26th.

Rainfall, 0.30 inch; normal, 3.10; rain record days, 15; normal, 16; greatest rainfall in one day, .06, on the 25th; total at Luakaha, 4.20; normal, 9.15; at Kapiolani Park, 0.13; normal, 2.00.

The artesian well level fell during the month from 34.05 to 33.95 feet above mean sea level. February 1, 1901, it stood at 34.03. The average daily mean sea level for January was 9.90 feet on the scale, 10.00 representing an assumed annual mean, and 9.86 the actual mean for ten years. There is evidently no reason for fear that the island is subsiding.

Trade wind days, 23 (4 of northeast); normal 14; average force (during daylight) Beaufort scale, 2.5. Cloudiness, tenths of sky, 3.7.

Approximate percentages of district rainfall: South Hilo, 28; North Hilo, 60; Hamakua, 50; Kohala, 60; Waimea, 68; Kona, 86; Kau, 25; Puna, 35; Maui, 50; leeward Oahu, 8; windward, Oahu, 40; Kauai, 28.

Mean temperatures: Pepeekeo, Hilo district, 100 feet elevation, average maximum, 76.7°; average minimum, 65.9°; Waimea, Hawaii, 2,730 elevation, 69.9° and 60.2°; Kohala, 521 elevation, 74.6° and 64.7°; Waiakoa, Kula, Maui, 2,700 elevation, 73.7° and 53.0°; Kulaokahua, W. R. Castle, 60 feet elevation, highest, 79°; lowest, 57°; mean, 70.3°.

Mr. Fleming, United States Coast and Geodetic Survey, magnetic observatory near Sisal, Ewa, Oahu, 50 feet elevation, furnishes the following figures: Rainfall, 0.09; mean maximum, 80.9°; mean minimum, 61.3° (probable mean temperature, 70.4°); dew-point at 9 a. m., 61.8°; 9 p. m., 60.7°; mean relative humidity, 76.

Kohala, Dr. B. D. Bond reports mean dew-point, 62.1°; relative humidity, 78.

The month of January was characterized by fine weather, the only noteworthy feature being the cold wave from the 24th to 27th.

Rainfall data.

Stations.	Elevation.	Jan., 1902.
HAWAII.	*Feet.*	*Inches.*
HILO, e. and ne.		
Waiakea	50	2.63
Hilo (town)	100	....
Kaumana	1,250	4.39
Pepeekeo	100	3.25
Hakalau	200	5.08
Honohina	300	7.47
Laupahoehoe	500	5.08
Ookala	400	....
HAMAKUA, ne.		
Kukaiau	250	3.29
Paauilo	750	....
Paauhau (Mill)	300	2.49
Paauhau (Greig)	1,150	....
Honokaa (Muir)	425	3.34
Honokaa (Rickard)	1,900	....
Kukuihaele	700	4.22
KOHALA, n.		
Awini Ranch	1,100	....
Niulii	200	3.02
Kohala (Mission)	521	2.75
Kohala (Sugar Co.)	235	3.83
Hawi	300	....
Hawi Mill	600	....
Waimea, c	2,720	2.64
KONA, w.		
Kailua	950	2.23
Holualoa	1,350	2.67
Kealakekua	1,580	3.47
Napoopoo	25	1.51
KAU, se.		
Kahuku Ranch	1,680	2.29
Waiohinu	1,000	2.43
Honuapo	15	0.16
Naalehu	650	0.89
Hilea	310	1.20
Pahala	850	....
Moaula	1,700	....
PUNA, e.		
Volcano House	4,000	4.78
Olaa	....	....
Olaa (17-mile)	1,700	4.15
Kapoho	110	....
Kalapana, se	....	....
MAUI.		
Lahaina, w	....	....
Waiopae Ranch, s	700	0.07
Kaupo (Mokulau), s	285	2.13
Kipahulu, s	300	....
Kahikinui	1,550	....
Hamoa Plantation, se	60	4.29
Nahiku (Anderson), ne	60	8.46
Nahiku (Nishwitz), ne)	800	2.36
Haiku, n	700	3.07
MAUI—*Continued.*	*Feet.*	*Inches.*
Kula (Waiakoa)	2,700	0.85
Kula (Erehwon), n	4,500	....
Puuomalei, n	1,400	2.19
Paia, n	180	1.33
Haleakala Ranch, n	2,000	2.18
Wailuku, ne	200	1.50
LANAI.		
Keomuku, e.	6	....
OAHU.		
Punahou (W. B.), sw	47	0.30
Kulaokahua, sw	50	0.15
Makiki Reservoir	150	0.11
Kewalo (King street), sw	15	....
U. S. Naval Station, sw	6	0.34
Kapiolani Park, sw	10	0.13
Manoa (Woodlawn Dairy), e.	285	1.30
School street (Bishop), sw	50	0.33
Pacific Heights, sw	700	0.60
Insane Asylum, sw	30	0.14
Kamehameha School	75	0.13
Kalihi-Uka, sw	260	1.42
Nuuanu (W. W. Hall), sw	50	0.29
Nuuanu (Wyllie street), sw	250	....
Nuuanu (Elec. Station), sw	405	0.63
Nuuanu (Luakaha), c	850	4.20
Waimanalo, ne	25	0.74
Maunawili, ne	300	1.58
Kaneohe, ne	100	....
Ahuimanu, ne	350	2.56
Kahuku, n	25	0.55
Waialua, n	20	0.01
Wahiawa, c	900	0.60
Ewa Plantation, s	60	....
Waipahu, s	200	0.00
Moanalua, sw	15	0.19
KAUAI.		
Lihue (Grove Farm), e	200	1.02
Lihue (Molokoa), e	300	0.95
Lihue (Kukaua), e	1,000	1.71
Kealia, e.	15	0.00
Kilauea, ne	325	1.48
Hanalei, n	10	2.19
Haena	15	1.25
Waiawa, sw	32	0.78
Eleele, s	200	0.40
Wahiawa Mountain, s	2,100	3.25
McBryde (Residence)	850	1.29
Lawai	450	1.04
Delayed December reports.		
Kailua	......	5.17
Waiakoa	......	4.56
Puuomalei	......	11.43

OBSERVATIONS AT HONOLULU.

The station is at 21° 18′ N., 157° 50′ W.

Hawaiian standard time is 10h 30m slow of Greenwich time. Honolulu local mean time is 10h 31m slow of Greenwich.

Pressure is corrected for temperature and reduced to sea level, and the gravity correction, —0.06 has been applied.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 12, or Beaufort scale. Two directions of wind, or values of wind force, or amounts of cloudiness, connected by a dash, indicate change from one to the other.

The rainfall for twenty-four hours is measured at 9 a. m. local, or 7.31 p. m., Greenwich time, on the respective dates.

The rain gage, 8 inches in diameter, is 1 foot above ground. Thermometer, 9 feet above ground. Ground is 43 feet, and the barometer 50 feet above sea level.

Meteorological Observations at Honolulu, January, 1902.

Date.	Pressure at sea level.	Temperature. Dry bulb.	Temperature. Wet bulb.	During twenty-four hours preceding 1 p. m. Greenwich time, or 1:30 a. m. Honolulu time. Temperature. Maximum.	Temperature. Minimum.	Means. Dew-point.	Means. Relative humidity.	Wind. Prevailing direction.	Wind. Force.	Average cloudiness.	Sea-level pressures. Maximum.	Sea-level pressures. Minimum.	Total rainfall at 9 a. m., local time.
	*	†	†			‡	‡		§				
1	30.13	68	58	71	63	53.0	58	nne.	3-4	5	30.17	30.07	0.00
2	30.11	70	62	74	66	55.0	60	nne.	3	6-3	30.16	30.08	0.00
3	30.11	70	64	75	66	60.7	69	ne.	3-4	2-6	30.14	30.08	0.01
4	30.08	71	66	76	67	62.3	72	ne.	3-4	5	30.13	30.01	0.01
5	30.11	73	65	76	69	65.3	78	ne.	3-4	6-4	30.13	30.00	0.01
6	30.07	72	64.5	77	71	62.7	68	ne.	4	4	30.14	30.04	0.00
7	30.02	71	65	76	71	62.3	68	ne.	4	5	30.11	29.98	0.01
8	29.96	66	64	76	70	61.0	67	ne.	3	4-8	30.05	29.92	0.00
9	29.91	67	64	76	64	63.0	79	s-sw.	1-0	8-2	29.99	29.86	0.03
10	29.96	67	58.5	78	66	63.5	80	w.	4-0	6-2	29.96	29.85	0.00
11	30.05	68	62	74	66	54.5	59	n.	3-4	1	30.08	29.98	0.00
12	30.05	70	62	75	67	58.0	64	ne.	3	3	30.09	29.99	0.00
13	30.04	69	63.5	76	68	59.0	66	ne.	3	4	30.11	30.02	0.00
14	30.00	70	65	76	67	61.7	74	nne.	3-1	5	30.07	29.96	0.01
15	30.01	66	65	77	66	62.3	73	ne.	3-0	5-1	30.04	29.94	0.04
16	30.07	72	66	78	63	63.3	75	ne.	3-1	3	30.10	30.01	0.00
17	30.05	72	64	77	70	62.3	69	ne.	3-4	3	30.12	30.02	0.02
18	30.04	70	65	77	69	60.7	66	ne.	4-2	4-1	30.09	29.98	0.00
19	30.04	72	64	77	70	62.0	69	ne.	3	3	30.10	30.00	0.00
20	30.05	72	66	77	72	61.5	66	ene.	4	3	30.10	30.00	0.01
21	30.00	64	62.5	78	70	62.3	70	ene.	4-2	8-3	30.11	30.00	0.00
22	29.95	63	61.7	78	62	63.7	82	ene.	2	4-6	30.03	29.90	0.02
23	29.90	64	62.5	78	62	62.3	77	e-n.	2-4	3-8	29.96	29.85	0.03
24	29.85	64	62	76	63	62.3	81	n-s.	2-0	4	29.95	29.84	0.00
25	29.83	59	56.3	76	64	59.0	78	n-w.	2-0	4-0	29.88	29.79	0.06
26	29.90	56	54.3	75	56	56.3	75	sw-n.	1-0	0-3	29.92	29.81	0.00
27	29.97	58	56.7	76	55.5	55.5	69	sw-ne.	1-0	0-1	29.98	29.87	0.00
28	29.95	60	58.7	76	56	58.0	70	nne.	0-3	0-4	30.00	29.90	0.00
29	29.91	66	63	77	60	61.0	80	e-ne.	2-0	1-6	30.00	29.89	0.01
30	29.93	68	65	77	60	62.3	76	nne.	3	5-1	29.99	29.87	0.02
31	29.96	73	68	78	65	64.0	75	ne.	2-5	4	30.01	29.91	0.01
Sums													
Means	30.000	67.4	62.5	76.5	65.6	60.7	72	....	2.5	3.7	30.055	29.949	0.30
Departure	+.050					−2.1	−4.7						

Mean temperature for January, 1902, (6 + 2 + 9) ÷ 3 = 70.8; normal is 70.1. Mean pressure for Janurary, 1902, (9 + 3) ÷ 2 = 29.995; normal is 29.950.

* This pressure is as recorded at 1 p. m., Greenwich time. † These temperatures are observed at 6 a. m., local, or 4.31 p. m., Greenwich time. ‡ These values are the means of (6 + 9 + 2 + 9) ÷ 4. § Beaufort scale.

MEXICAN CLIMATOLOGICAL DATA.

Through the kind cooperation of Señor Manuel E. Pastrana, Director of the Central Meteorologic-Magnetic Observatory, the monthly summaries of Mexican data are now communicated in manuscript, in advance of their publication in the Boletin Mensual. An abstract, translated into English measures, is here given in continuation of the similar tables published in the MONTHLY WEATHER REVIEW since 1896. The barometric means are now reduced to standard gravity.

Mexican data for January, 1902.

Stations.	Altitude.	Mean barometer.	Temperature. Max.	Temperature. Min.	Temperature. Mean.	Relative humidity.	Precipitation.	Prevailing direction. Wind.	Prevailing direction. Cloud.
	Feet.	*Inch.*	° *F.*	° *F.*	° *F.*	%	*Inch.*		
Chihuahua	4,669	25.20	77.0	32.0	54.3	38	......	sw.	....
Guadalajara (Obs. del. Est.)	5,186	24.94	78.3	41.0	60.3	51	......	nw.	....
Leon (Guanajuato)	5,906	24.28	75.7	32.7	55.9	53	......	ne.	....
Mazatlan	25	29.93	76.6	57.7	69.4	74	T.	nw.	....
Merida	50	30.05	94.1	48.0	70.7	65	......	ne.	....
Mexico (Obs. Cent.)	7,472	23.02	73.0	32.9	53.1	48	......	ne.	se.
Monterrey (Sem.)	1,626	28.28	89.4	34.2	56.8	72	0.67	w.	....
Morelia (Seminario)	6,401	23.93	74.1	30.2	55.8	56	......	ne.	....
Puebla (Col. Cat.)	7,125	23.31	72.0	37.4	55.6	52	......	e.	....
Puebla (Col. d Est.)	7,118	23.33	77.0	29.5	52.9	56	......	ene.	....
Queretaro	6,070	24.15	77.0	33.1	56.7	50	......	e.	....
Saltillo (Col. S. Juan)	5,399	24.77	75.7	38.3	54.1	63	T.	ne.	....
S. Isidro (Hac. de Gto)	....	....	68.0	51.4	....	....	......	w.	....
Toluca	8,812	21.93	71.6	22.3	48.2	48	......	w.	....
Zapotlan	5,078	25.08	80.1	38.8	61.3	60	......	sse.	....

CLIMATOLOGY OF COSTA RICA.

Communicated by H. PITTIER, Director, Physical Geographic Institute.

TABLE 1.—*Hourly observations at the Observatory, San Jose de Costa Rica, during January, 1902.*

Hours.	Pressure. Observed, 1902.	Pressure. Normal, 1889-1900.	Temperature. Observed, 1902.	Temperature. Normal, 1889-1900.	Relative humidity. Observed, 1902.	Relative humidity. Normal, 1889-1900.	Rainfall. Observed, 1902.	Rainfall. Normal, 1889-1900.	Rainfall. Duration, 1902.
	660+ Mm.	660+ Mm.	° C.	° C.	%	%	Mm.	Mm.	Hrs.
1 a. m	4.52	3.96	16.15	16.36	82	85	0.5	0.1	0.83
2 a. m	4.10	3.55	15.85	16.16	82	85	0.0	0.0	0.00
3 a. m	3.77	3.14	15.61	15.96	83	86	0.1	0.1	0.67
4 a. m	3.63	3.14	15.61	15.80	81	86	0.0	0.2	0.00
5 a. m	3.75	3.27	15.48	15.66	80	86	0.0	0.3	0.00
6 a. m	3.92	3.57	15.40	15.00	82	86	0.0	0.2	0.00
7 a. m	4.23	3.83	15.43	15.09	82	86	0.0	0.4	0.00
8 a. m	4.60	4.31	16.15	16.55	76	81	0.0	0.3	0.00
9 a. m	4.99	4.66	18.37	19.28	69	73	0.0	0.4	0.00
10 a. m	5.13	4.76	20.13	21.15	66	68	0.0	0.0	0.00
11 a. m	5.03	4.56	21.36	22.50	63	64	0.0	0.0	0.00
12 m	4.61	4.17	22.17	23.25	61	62	0.0	0.1	0.00
1 p. m	4.05	3.60	22.95	23.75	59	61	0.2	0.4	0.17
2 p. m	3.45	3.00	22.65	23.81	61	61	0.7	0.2	1.00
3 p. m	3.11	2.56	22.47	23.40	61	63	0.5	0.5	1.00
4 p. m	2.86	2.45	21.47	22.55	65	65	0.1	2.0	0.17
5 p. m	2.96	2.55	19.90	21.28	71	69	0.0	2.9	0.00
6 p. m	3.29	2.78	18.51	19.74	76	75	0.3	0.9	0.83
7 p. m	3.71	3.22	17.61	18.48	79	79	0.3	0.6	0.17
8 p. m	4.12	3.72	17.16	17.92	81	82	1.5	1.1	1.83
9 p. m	4.63	4.09	17.02	17.61	81	82	0.2	0.1	1.17
10 p. m	4.89	4.37	16.86	17.20	81	83	0.0	0.6	0.00
11 p. m	4.89	4.41	16.61	16.88	82	85	0.3	0.4	0.58
Midnight	4.75	4.24	16.42	16.61	81	85	0.5	0.1	1.00
Mean	664.14	663.66	18.18	18.83	74	77	......	......	......
Minimum	661.4	660.04	13.0	9.7	38	......	......	......	......
Maximum	667.1	668.12	27.3	30.3	95	......	0.9	......	......
Total	......	......	......	......	......	......	5.2	11.8	9.42

REMARKS.—The barometer is 1,169 meters above sea level. Readings are corrected for gravity, temperature, and instrumental error. The dry and wet bulb thermometers are 1.5 meters above ground and corrected for instrumental errors. The hourly readings for pressure, and wet and dry bulb thermometers, are obtained by means of Richard registering instruments, checked by direct observations every three hours from 7 a. m. to 10 p. m. The hourly rainfall is as given by Hottinger's self-register, checked once a day. Under maximum, the greatest hourly rainfall for the month is given. The standard rain gage is 1.5 meters above ground. Since January 1, 1902, observations at San Jose has been made on seventy-fifth meridian time, which is 0 hours, 36 minutes, 13.3 seconds *in advance* of San Jose local time. The normals for pressure, temperature, and relative humidity have been adjusted to this time; the normal for rainfall in Table 1 and the sunshine observations and normal in Table 2 refer to local time.

TABLE 2.

Time.	Sunshine. Observed, 1902.	Sunshine. Normal, 1889-1900.	Cloudiness. Observed, 1902.	Cloudiness. Normal, 1889-1900.	Temperature of the soil at depth of— 0.15 m.	0.30 m.	0.60 m.	1.20 m.	3.00 m.
	Hours.	Hours.	%	%	° C.	° C.	° C.	° C.	° C.
7 a. m	5.55	8.28	49	39	18.90	19.06	19.58	20.00	20.67
8 a. m	17.47	22.43	......	......	......	......	......	......	......
9 a. m	18.56	22.55	......	......	......	......	......	......	......
10 a. m	21.07	20.73	52	44	19.11	19.13	19.65	20.07	......
11 a. m	18.16	19.74	......	......	......	......	......	......	......
12 m	15.62	18.42	......	......	......	......	......	......	......
1 p. m	13.77	17.99	61	53	19.47	19.27	19.68	20.09	......
2 p. m	16.69	19.74	......	......	......	......	......	......	......
3 p. m	16.20	19.23	......	......	......	......	......	......	......
4 p. m	14.09	17.44	62	57	19.74	19.30	19.60	19.99	......
5 p. m	10.31	12.70	......	......	......	......	......	......	......
6 p. m	1.99	2.54	......	......	......	......	......	......	......
7 p. m	......	......	64	55	19.69	19.40	19.63	20.01	......
8 p. m	......	......	......	......	......	......	......	......	......
9 p. m	......	......	......	......	......	......	......	......	......
10 p. m	......	......	45	44	19.48	19.36	19.64	20.00	......
11 p. m	......	......	......	......	......	......	......	......	......
Midnight	......	......	......	......	......	......	......	......	......
Mean	......	......	55	49	19.41	19.27	19.64	20.01	20.67
Total	169.48	201.79	......	......	......	......	......	......	......

TABLE 3.—*Rainfall at stations in Costa Rica, January, 1902.*

Stations.	Height above sea level.	Observed, 1902. Amount.	Observed, 1902. Number of days.	Normals. Number of years.	Normals. Amount.	Normals. Number of days.
		Mm.			Mm.	
Sipurio (Talamanca)	60	*	*	1	385	17
Boca Banano	3	450	23	6	308	19
Limon	3	502	21	7	308	18
Swamp Mouth	3	184	20	4	305	18
Zent	20	555	17	9 mo.	......	......
Siquirres	60	460	17	3	471	14
Guapiles	300	426	19	2	340	13
Cariblanco (Sarapiqui)	835	1,078	28	4	373	20
San Carlos	161	315	22	4	234	17
Las Lomas	266	*	*	2	521	16
Peralta	332	370	23	4	222	15
Turrialba	620	*	*	7	225	16
Juan Viñas	1,040	308	26	6	211	10
Santiago	1,090	*	*	9 mo.	......	......
Paraiso	1,336	110	20	6 mo.	......	......
Cachi	......	77	23	......	......	......
Orosi	1,068	*	*	......	......	......
Las Concavas	......	64	24	5 mo.	......	......
Cartago	1,450	74	27	3	92	14
Tres Rios	1,300	23	7	12	18	4
San Francisco Guad	1,187	10	6	6	20	5
San Jose	1,160	5	6	13	12	3
La Verbena	1,140	3	5	6	35	5
Nuestro Amo	......	0	0	6	0	0
Alajuela	950	0	0	2	0	0
San Isidro Alajuela	1,346	0	0	9 mo.	......	......

* Observations not received.

TABLE 4.—*Observations taken at the stations of Port Limon and Zent, January, 1902.*

Stations.	Pressure. Minimum.	Pressure. Maximum.	Pressure. Mean.	Temperature. Minimum.	Temperature. Maximum.	Temperature. Mean.	Relative humidity.
	Inches.	Inches.	Inches.	°	°	°	%
Port Limon	763.3	768.4	765.71	20.1	30.5	23.54	88
Zent	......	......	......	18.5	32.3	23.85	86

Stations.	Cloudiness.	Sunshine.	Rainfall. Amount.	Rainfall. Number of days.	Temperature of soil at depth of— 0.15 m.	0.30 m.	0.60 m.
	%	Hours.	Mm.		°	°	°
Port Limon	79	......	502	21	......	......	......
Zent	80	89.58	555	17	24.10	23.97	24.43

REMARKS.—At Port Limon the hours of direct observation are 8 a. m. and 2 and 8 p. m., San Jose local time; the means for temperature and relative humidity are obtained from two-hourly readings given by a Richard self-registering thermometer.

Notes on the weather.—On the Pacific slope the beginning of the month was exceptionally cold and windy, with occasional showers, but conditions had improved by the 16th. In San Jose the pressure was generally high, especially at the beginning and end of the month. Sunshine was much below the normal, and the coffee crop was somewhat injured by the damp weather. The rainfall was excessive all along the Atlantic slope, causing numerous inundations and landslides along the railroad. In Port Limon no steamer could approach the new wharf during an entire week, and over 60,000 bunches of bananas had to be thrown into the sea.

Notes on earthquakes.—January 5, $10^h\ 2^m$ p. m., slight shock, intensity II, direction NNW-SSE, duration 3 seconds. January 13, $2^h\ 5^m\ 21^s$ p. m., slight shock, intensity II, direction NNE-SSW, duration 12 seconds. January 16, $4^h\ 18^m$ p. m., very slight tremor, direction ENE-WSW, duration (?). January 18, $5^h\ 55^m$ p. m., tremors; $7^h\ 53^m$ a. m., light shock,

intensity II, direction NE-SW, duration 7 seconds. January 20, 3h 48m a. m., light shock, intensity II, direction NNE-SSW, duration 7 seconds. January 23, 10h 41m p. m., tremors. January 28, 4h 56m a. m., several short shocks, direction NNE-SSW, intensity III, duration 12 seconds; January 28, 1h 1m p. m., pretty strong shocks, direction NNE-SSW, duration 20 seconds, intensity IV.

RECENT PAPERS BEARING ON METEOROLOGY.

W. F. R. PHILLIPS, in charge of Library, etc.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau:

Science. London. Vol. 15.
Ward, Robert DeCourcy. Rainfall, Commerce, and Politics. [Review of article by H. H. Clayton.] Pp. 110-111.
Ward, Robert DeCourcy. Economic Effects of Last July's Heat and Drought. P. 111.
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Ward, Robert DeCourcy. Weather Tetanus. [Review of circular published by Camden, N. J., Board of Health.] Pp. 111-112.
Scientific American. New York. Vol. 86.
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Rotch, A. Lawrence. Kites and Wireless Telegraphy. P. 198.
Milne, J. What are Seismometers Indicating? Pp. 202-203.
G., C. C. Electric Waves. Pp. 211-212.
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Bauer, L. A. Results of International Magnetic Observations made during the Total Solar Eclipse of May 17-18, 1901. Pp. 246-247.
Fuller, Thomas. An unusual Rainbow. P. 273.
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Wollny, E. Influence des sels solubles sur l'humidité du sol. Pp. 63-64.
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Grohmann, —. Die klimatischen Verhältnisse des königreiches Sachsen in ihrer Abhängigkeit von Luftdruck und Windursprung. Pp. 1-14.

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Meinardus, W. Die Temperaturverhältnisse im November, 1901, unter etwa 50° N. Br. P. 18.

Assmann, R. Drachenversuche auf See. Pp. 19-20.

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EARTHQUAKES, CLOUDS, AND GALES AT PORT CAROLINA, SOUTH AUSTRALIA.[1]

By GEO. H. STYLES, Harbormaster and Subcollector, Port Caroline, South Australia, dated March 21, 1901.

The weather during the month preceding the earthquake of May 10, 1897, had been thick and squally, with the wind all round the compass. On the day of the disturbance its force, which had been 6 to 8 for several days, fell to 2. The direction was northeast and the weather fine with cirro-stratus clouds.

My residence and place of observation is on the beach, latitude, 36° 30′ 6′′ south; longitude, 139° 51′ 13′′ east. The noise of the earthquake was heard for about seventy seconds, coming from north to south, and was followed by a shock which damaged every house for miles around. One house 8 miles north of Robe was thrown down and many others were rendered uninhabitable. In places on the flat country there were fissures in the ground some hundreds of yards in length, and open down to the level of the water in the wells. About 10 square feet of the limestone crust was lifted several feet by the pressure of water underneath, and the water flowed outward for two days. From Robe to Beachport the ground subsided in places 20 feet. There was an upward pressure from below which filled some wells to the brim with tightly pressed sand. Water percolated through the ground in places, as if forced through a colander. The tide ebbed some 8 feet immediately before the shock, and an hour later it rose 10 feet. Pendulum clocks stopped at the same minute from Port Augusta in South Australia, to Sydney in New South Wales. The center of the disturbance, or more properly speaking the center of its manifestation, was around Mount Benson, between Kingston and Robe, about 20 miles south of this place. The lower the land the greater the shock. Buildings damaged showed the effects of a twist (apparent[2]). Chimneys not thrown down were twisted from their bases. Hanging pictures were in many instances turned with their faces to the wall. Ornaments on a mantelshelf were thrown across the room on to a table. Persons and dogs were made giddy, and vomited. A 7-inch horseshoe magnet, hanging by its armature on a copper nail in my window, was swung round and hung by its bow, still keeping its armature. This was repeated some months later, on which occasion the armature was flung off. Other shocks followed, minor ones, force 4 to 6, averaging two per hour, during the month of May. In June they averaged four each day; in July, two daily. Since then they have gradually decreased in number, and only one was recorded last month, and one, force 4, this month (March, 1901). Their intensity lately has been 2, 3, and 4 on the Rossi-Forel scale.

* * * * * * *

During all these tremors the sky was usually covered with heavy cumulus clouds, one or two of them bright, as though lighted by the moon even during the darkest moonless nights. No two cumulus clouds ever coalesced. On one overtaking another, they were mutually repelled, and drifted away in feathery flakes. I never saw one, even the largest cumulus cloud, reach the opposite horizon. It had to melt into clear sky. We have no longer the blue sky of the old days; it is of a milky and watery color, and never deeper blue than that on Plate XI in the United States Hydrographic Office classification of clouds. * * * We have also a thin cigar-shaped cloud, parallel with the horizon. This cloud, or there may be two, is very dark, and it is sharply defined. Having no ragged edges, it is as though it had been shaped with an edged tool, and though a gale may be blowing at force 10 the cloud will be stationary. I saw one once for twelve hours, when night hid it.

* * * * * * * *

A reference to the sailing directions for this place will show it to be an open roadstead exposed to the fury of the worst storms. Yet the bay is seldom rough, and then only for a few hours. During the worst weather that I have seen here for over twenty-three years, a vessel could lie in safety at the anchorage. No one has yet accounted for it satisfactorily. In my opinion, the smoothness of the bay is caused by a fresh water river, which I have found running through the sand under the sea into the bay, and also, by fresh water springs which, in many places, may be seen coming up from the bottom in the bay. Their influence may be inferred from the fact that I have tested the density of the water with a salinometer on several occasions, and have found it to be one-third fresher than average sea water. I account for the absence of wind in

[1] In printing the above letter the Editor has omitted a few sentences suggesting possible magnetic and electric relations, but has retained the interesting meteorological facts.

[2] Mallet demonstrates that these twists are probably merely the resultant of the straight line motion of the earth combined with the irregular form, or unequal strength, or fastenings of the damaged object.—*C. A.*

two ways: First, a granite reef crosses from Kangaroo Island to the mainland, at a place 10 miles north of Kingston jetty. It is marked on the chart "Nation Reef" and "Granite Rocks." I have never known a thunderstorm from the northward to cross this reef. It invariably follows it into the interior. The rains may come on here, in part, but the storm follows the reef. A gale was reported to me by the head keeper, Cape Jaffa Lighthouse, 11 miles south of this place, as having been the heaviest he had known during twenty years duty there. The sea broke over the lantern, which is 120 feet above the sea level. During that day there were 8 fishing boats out from here, small centerboard luggers, with two men in each boat. They fished about 6 miles out and for want of wind had to pull home. The wind and sea were dead calm in Lacepede Bay; the gale went over our heads and descended about 10 miles inland, doing considerable damage. I have seen many similar instances, and have never heard them accounted for, as there is nothing to give us a lee. In ordinary weather the bay is full of cross currents of wind and sea.

* * * * * * *

Whatever may be the nature of the influence that generally prevents outside gales from blowing their proper course through the bay, it is intermittent, as gales occasionally blow home with undiminished force.

Mr. James Page of the United States Hydrographic Office adds the following note.—Ed.:

Kingston (Port Caroline) is situated in Lacepede Bay on the south coast of Australia; latitude 36° 50′ 16′′ south; longitude 139° 50′ 56′′ east. Robe is on the coast 20 miles to the southward. Concerning Lacepede Bay the Australia Directory, Volume I, p. 361, states as follows: "It is a remarkable fact that this bay, although apparently exposed to the ocean swell, affords safe anchorage in all weather, there being tolerably smooth water even on the highway of a westerly gale. Two reasons account for the smoothness of the water—the force of the prevailing swell from the southwest is broken by the reefs off Cape Jaffa, and that from the northwest and west by traversing, before it arrives near the anchorage, a long extent of undulating ground with shallow water over it, there being only 20 fathoms 16 miles west of Kingston jetty."

JANUARY GALES FROM THE GREAT LAKES TO THE MARITIME PROVINCES.

By B. C. WEBBER, Forecast Official and Inspector to the Meteorological Service of Canada, dated February 19, 1902.

In treating of the storms which have been experienced in Canada from the Great Lakes to the Maritime Provinces in January from the years 1874 to 1902, inclusive, the writer does not intend to enter to any extent into the question of the why and wherefore of the development of these storms, or to discuss whether or no the course of storms is governed by the anticyclones or the many other vexed questions upon the subject which have been from time to time considered. Having gained considerable assistance himself in forecasting, by the tabulation and study of the storms of the different months of the year, he may possibly be able to point out a few salient features which may be available to others in scientific weather forecasting. As a review of the twelve separate months would necessarily occupy a large amount of space, the month of January only will at present be considered. In the first place perhaps it will be as well to give a table of the number of low areas charted, the percentage of storms caused by them, and the percentage of storms caused by lows from the several directions.

In explanation it should be stated that northwest lows are those originating or moving from the region between the British Columbia coast and Manitoba; west lows, those from the Pacific coast and Western States between latitudes 48° and 35°; southwest lows, from lower California, Mexico, Texas, and the Gulf of Mexico; Atlantic lows, as designated; erratic lows, developing anywhere from the lakes east to the Maritime Provinces including the New England States.

TABLE 1.—*Number of lows and the direction from which they came.*

Total number.	Northwest.	West.	Southwest.	Atlantic.	Erratic.
330	129	61	87	24	9

TABLE 2.—*Percentage of low areas causing gales; also percentage of gales from areas moving from the several directions.*

District.	Total No. of gales.	Total per cent of areas causing gales.	Per cent from northwest.	Per cent from west.	Per cent from southwest.	Per cent from Atlantic.
Lakes	162	49.9	45.0	64.0	54.0	0.0
Lower St. Lawrence and Gulf.	167	50.6	32.2	49.2	65.5	50.0
Maritime Provinces	176	53.3	29.5	50.8	78.2	75.9

In referring to Tables 1 and 2 we are at first impressed with the few erratic lows or abnormal developments, yet on second reflection we realize that were such conditions of frequent occurrence the efficiency reached to-day in scientific weather forecasting could not have been obtained; consequently we learn that normal movements are to be expected, not abnormal or highly improbable, as we are at times apt to endeavor to persuade ourselves is to be the case.

The percentage of gales caused by northwest lows diminishes rapidly as we proceed eastward; this is instructive, showing as it does that a considerable number of this class of areas decrease in energy as they progress toward the Atlantic. The same conditions hold good as regards the west lows, but to a lesser extent; a much larger percentage of west than of northwest lows cause storms however. This may in a measure be accounted for by the frequency with which in this class of areas the secondary developments occur, without which the primary system does not as a rule long retain its energy. Referring to the southwest lows we find the conditions practically reversed, for the percentage of gales caused by these areas increases rapidly as the eastern portion of the continent is reached. This knowledge is again useful, indicating as it does that a considerable number of these important disturbances do not affect the Lake region to any extent. When we come to the Atlantic series of areas, or those disturbances which either pass up toward the Maritime Provinces from the United States Atlantic coast or from far out to sea, it is seen that in the long period herein considered none of these areas gave a storm in the Lake region; and further, that a large number moved so far to the southward of Nova Scotia that their influence did not extend as far to the northward as the Gulf of St. Lawrence, suggesting that the gales caused by them are more likely to be backing than veering.

The gales of January have been separated into three classes: those of great violence, the fresh gales, and the moderate storms. Combining the first two classes, the percentage of the fresh to heavy gales for the districts is as follows: lower lakes, 46.3 per cent; lower St. Lawrence and Gulf, 65.9; Maritime Provinces, 53.4. Therefore fresh to heavy gales are more numerous in the Maritime Provinces than in the Lake region, and still more frequent in the lower St. Lawrence and Gulf. In the Lake region the gales of a marked heavy type were 25, or less than 1 for each January. In the lower St. Lawrence Valley and the Gulf the maximum was reached with 68, while in the Maritime Provinces there were 54.

The question naturally arises, what is the cause of these violent gales? Can any reasons be given for their development, and are there any guides to aid in anticipating these great atmospheric disturbances? In the first place the violent

TABLE 1.—*Mean maximum, minimum, and range of temperature at the Weather Bureau and Forest Park observatories, St. Louis, Mo.*

	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.		Five-year averages.	
	W. B.	F. P.	W. B.	F. P.	W. B.	F. P.	W. B.	F. P.	W. B.	F. P.	W. B.	F. P.	W. B.	F. P.	W. B.	F. P.	W. B.	F. P.	W. B.	F. P.	W. B.	F. P.	W. B.	F. P.	W. B.	F. P.
Maximum	42.8	41.9	43.9	43.8	45.9	44.8	67.4	66.7	72.8	72.1	84.1	82.7	83.8	82.3	83.4	82.8	84.3	84.3	67.2	67.3	47.8	47.8	50.8	50.8	64.1	63.5
Minimum	30.5	28.0	27.9	25.0	32.0	30.4	50.0	45.6	54.3	48.8	67.3	63.6	66.0	60.5	66.2	61.4	63.8	54.8	47.9	42.1	35.1	32.9	34.7	33.2	47.5	42.9
Range	12.3	13.9	16.0	18.8	13.9	14.4	17.4	21.1	18.5	23.3	16.8	19.1	17.8	21.8	17.2	21.4	20.5	29.5	19.3	25.2	12.7	14.9	16.1	17.6	16.6	20.6
Diff. in min., W. B.—F. P.	2.5		2.9		1.6		4.4		5.5		3.7		5.5		4.8		9.0		5.8		2.2		1.5		4.6	

gales caused by northwest lows are few in number, and they appear to be of three types: The low which steadily increases in energy as it drifts eastward; the low immediately succeeded by a great cold wave; and the low which at first travels far southeastward, and then suddenly recurves northeastward. The violent gales from west lows are even fewer than those from the northwest; but a suggestion has already been hinted at elsewhere in this paper regarding this class of areas. The southwest low so frequently shows such energy from its apparent inception that no doubt exists as to its ultimate destructive character; but if in a seemingly weak area two or more foci appear, or should there be a secondary development in the southern part of the system, or on or near the United States Atlantic coast, usually in the vicinity of New Jersey or Connecticut, then a storm of great violence almost invariably ensues. There are not many Atlantic lows, as will be seen by referring to the table; nearly all, however, bring a gale to the Maritime Provinces, although the violent gales caused by them are few in number, doubtless owing to their general course being far to the southward of Nova Scotia.

The erratic developments herein considered must not be confounded with the erratic change of the course of a low from the normal to the abnormal, which from time to time is observed. These apparent peculiar or backward movements of depressions are so rare that they hardly enter into the consideration; however, it would be very interesting to have the opinion of others on the causes of these sporadic movements, especially as there are instances on record where, owing to such conditions, the gale which had seemingly subsided has again set in with greater violence than before.

ABSTRACT OF A COMPARISON OF THE MINIMUM TEMPERATURES RECORDED AT THE UNITED STATES WEATHER BUREAU AND THE FOREST PARK METEOROLOGICAL OBSERVATORIES, ST. LOUIS, MO., FOR THE YEAR 1891.[1]

By W. H. HAMMON and F. W. DUENCKEL.

Forest Park, St. Louis, Mo., is a tract of ground about 1 mile wide from north to south and 2 miles long from east to west, its eastern boundary being about 4 miles west of the Mississippi River. About midway between the park and the river, at Thirty-sixth street, is a slight elevation, and east of this, in Mill Creek Valley and along the banks of the Mississippi, the principal manufactories are located.

The principal railroads from the west enter the city by way of the valley of the River des Pères and Mill Creek Valley. Along these railroads are several manufactories, but the nearest of any importance is 1¼ miles south of the southeast corner of the park.

From this it seems that the park is quite well removed from the smoke and other conditions peculiar to large cities, except when east winds, which are infrequent, prevail.

The observatory is located on a slight knoll about half a mile from the east end of the park and midway between the northern and southern boundaries. About 100 yards to the north and 30 feet lower than the observatory is a valley through which flows a small stream, while to the southwest is quite a heavy forest growth extending back from the observatory to the top of a slight ridge. In other directions are open lawns interspersed with small groves of trees.

The thermometer shelter, which is of the Weather Bureau pattern, is located about 96 feet east of the observatory building, 10 feet above the sod, and 75 feet from the nearest trees.

The anemometer is exposed 8 feet above the roof of the observatory and 58 feet above ground. It is on a general level with the tops of surrounding trees.

The observatory of the United States Weather Bureau is located in the Government building at Eighth and Olive streets, a little more than half a mile from the river. It is surrounded on all sides by chimneys belching forth smoke from bituminous coal, which is almost the exclusive fuel of the city. The building covers an entire block 300 feet square, and is arranged about a court which is open to the lower floor.

The thermometer shelter is located 10 feet above the copper roof of this building, and 110 feet above the level of the street.

On the center of the south front of the building is a tower 200 feet high, on the top of which the anemometer is exposed far above the tops of surrounding structures.

Table 1 shows the monthly means of the daily maximum, minimum, and range of temperature during the year 1891, at both the Weather Bureau and the Forest Park stations. It also shows the differences between the monthly mean minimum temperatures at the two stations, and the annual averages for the above data for the five years 1891–1895, inclusive.

The noteworthy feature of this table is the difference in the monthly mean minimum temperatures at the two stations, the Forest Park minimums averaging from 9.0° lower in September to 1.5° lower in December. The extreme differences have ranged from 20° lower to 2° higher.

In order to study these remarkable differences, tables were prepared in which were entered the minimum temperature recorded at 8 a. m., the cloudiness at 8. a. m. and the previous 8 p. m., and the average wind velocity during the night. Curves were also drawn showing the relation between the cloudiness, the velocity of the wind, and the minimum temperature differences at the two stations. In general it was found that as the cloudiness increased the wind velocity also increased, and the differences between the minimum temperatures decreased. It was also found that both the cloudiness and the velocity of the wind exerted an influence upon the minimum temperature differences.

In the study of these observations it was found that during the clear skies of September the maximum differences were recorded, while during the cloudiest months (March and December), the differences were least, and that they remained small during all the winter months. There were, however, marked exceptions to this rule, as for instance in January, 1892, when the difference exceeded 20° on three successive days. During this period there was a heavy covering of snow on the ground at the park and for a portion of the time there was a little snow in the city, but it was soon covered with soot and quickly disappeared.

A special study was made of the minimum temperature differences on all the days when snow was on the ground at the

[1] Compiled by W. H. Hammon, Forecast Official United States Weather Bureau, and F. W. Duenckel, of the Forest Park Meteorological Observatory; read before the St. Louis Academy of Science, March 2, 1896, and now first published.

park, and it was found that the average difference almost equalled that for September.

The following quotation is from an article "On the influence of the accumulations of snow on climate," by Alexander Woeikoff, Quarterly Journal of the Royal Meteorological Society, Vol. XI, 1885, p. 299.

> A covering of snow on the ground acts, firstly, as a bad conductor, rendering the interchange of temperatures between the surface of the ground and the lower stratum of air much slower than when the snow is absent.
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> * * * * * * *
>
> We see that as a covering of snow protects the upper parts of the ground from radiation and makes the conduction of heat much slower than it would otherwise be, it thus tends to raise the temperature of the soil; but it must have a contrary influence on the lowest stratum of the air, as the snow protects it from the conduction of heat from the ground, an action which, as this is generally warmer in winter, must make the lowest stratum of the air colder. This it undoubtedly does; but in this respect another quality of the snow is even more important, namely, that it is a good radiator of heat.

The influence of smoke from the factories of the city upon the minimum temperature differences has also been studied. It was invariably noticed that on the day preceding a night with an unusually large minimum temperature difference, the wind which had been from the north, became calm. On the eastern horizon the smoke of the city appeared very dense and extended upward to an unusual height, while at the park the sky was very clear. On the following morning the wind changed to the south and gradually increased in velocity.

If two or more consecutive days showed a remarkable difference in the minimum temperatures at our two stations, as was the case in January, 1892, it was because the air remained calm and clear at the park, while the smoke appeared to be heaped up over the city. Invariably at such times the barometer indicated the presence of the crest of an area of high pressure, and its passage accounted for the change in the direction of the wind.

It thus appears that the principal cause of the difference in the minimum temperature readings at the Forest Park and the Weather Bureau observatories is the accumulation of smoke over the city, especially on nights when the sky is clear and the wind light. These conditions favor a rapid radiation of heat from the ground at the park, while the smoke over the city acts like a cloud covering and materially retards radiation.

It is well to notice here the advantages that arise from selecting the northwesterly sections of a city for residence purposes and southeasterly sections for manufacturing purposes.

STUDIES ON THE STATICS AND KINEMATICS OF THE ATMOSPHERE IN THE UNITED STATES.

By Prof. FRANK H. BIGELOW.

I. A NEW BAROMETRIC SYSTEM FOR THE UNITED STATES, CANADA, AND THE WEST INDIES.

On January 1, 1902, at the 8 a. m. observation, seventy-fifth meridian time, a new system for the reduction of the station barometric pressures to the sea-level plane, was put in operation for the United States, Canada, and the West Indies. The daily weather maps used in forecasting the intensity and the path of storms, and the other allied phenomena, are therefore constructed upon a basis differing from any hitherto used. Students who consult the published weather maps should remember that the series terminating with the above date is not comparable with the others following it, the difference at some stations on the Rocky Mountain Plateau for certain seasons of the year amounting to several tenths of an inch of pressure by the mercurial barometer. The problem of reducing the pressures observed at stations located on the Rocky Mountain Plateau to sea level has always been recognized as one of unusual scientific difficulty, and it has been under discussion in the Washington Office at intervals ever since the establishment of the Government service. So far as can be judged at the present writing the success of the new system is assured, and if this favorable opinion is confirmed by continued use, it will mark the termination of thirty years' effort to solve this question in a practical form. The other plateau districts of the world, Mexico, South America, especially Argentina, south Africa, Australia, and southern Asia, will doubtless profit by the experience of the United States Weather Bureau, on consulting the solution adopted for the United States, Canada, and the West Indies.

Prof. R. F. Stupart, Director of the Canadian Meteorological Office, has courteously cooperated by supplying the necessary data for the Canadian stations, since the common interests of both countries require the adoption of the same methods of barometric reductions. There is no task properly belonging to the Weather Bureau upon which more time and labor has been expended than upon this problem, and the present discussion is the sixth well defined attempt to reach a satisfactory conclusion. The importance of putting the barometric pressures on the elevated plateau, covering one third of the territory for which the official forecasts are made, on a satisfactory scientific basis, fully justifies this work, because it is of primary importance not to attribute to weather conditions any pressure changes that are in reality due to the method of reduction to the plane of reference.

PRELIMINARY REMARKS.

The eastern and central portions of the United States and Canada are generally at levels less than 1,000 feet above the sea, and also the Pacific coast is at low level, so that for these districts the barometric reduction offers no difficulty. Between these, throughout the Rocky Mountain region, there is a rough country where the stations are at different elevations up to 7,000 feet, where the surface temperature conditions range enormously, say from $-40°$ F. to $+60°$ F. on a single map in extreme cases, where the prevailing winds from the Pacific Ocean produce one type of weather on the western slopes of the mountains and another on the eastern, to say nothing of the effect of great arid districts between them, and where the configuration of the mountain valleys, in which many of the stations are located, relative to the neighboring ranges rising up to 12,000 or 14,000 feet in some cases, causes various local peculiarities in the behavior of the barometer.

A description of the construction of our new station pressure normals is properly a preliminary to the solution of the plateau problem. In the years between 1871–1880, while the barometric network was being extended over the plateau districts, many of the elevated stations were at the Army posts where no measurement of the altitude had been made, except by the barometer. We now know that several of these early elevations were seriously in error, say from 10 feet up to 200 feet, and as a change of 10 feet in altitude corresponds approximately to 0.010 inch pressure, the irregularities on the sea-level plane arising from this source alone were not inconsiderable. The gradual extension of the various surveys by the Government over the plateau, together with the railroad levels executed and revised by the different companies, have gradually built up a system of check levels at intersecting points, with accurate differential levels between them, so that now the absolute elevations of the several stations have been determined with much accuracy. An adjustment of these levels was made by Prof. Cleveland Abbe in 1871–72; the work was then taken up by the Geological Survey, and the latest results of these surveys are given in Gannett's Dictionary of Altitudes, edition of 1900. The Weather Bureau was supplied with the corrected altitudes before the publication of this report by the Geological Sur-

vey, so that we have had the advantage of this data from an early stage in our own work.

THE ADOPTED STANDARD ELEVATION FOR THE EPOCH, JANUARY 1, 1900.

Besides the incorrect actual elevations which, for one reason or another, have been adopted during thirty years, there have been numerous changes in the elevation of the local offices of the service at the same station, involving many small variations in the altitude above sea level. A very careful reexamination of the station records of the respective stations showed that it was practically impossible to assign correct absolute elevations for the several changes as referred to the sea level, but that it was possible to discover the differences by which the successive changes in height followed each other (that is, the height of the barometer in the new office above or below that in the old office), the series of variations giving a chain of steps up and down in the succession of changes. These were carefully determined, and they were then applied to the elevation occupied by the station at the epoch January 1, 1900, so that the actual heights were thus found for the respective intervals during which the barometer remained in one position, and they were referred in this way to our latest and best elevations as given by recent surveys. Having adopted the elevation for the station at the given epoch, all the recorded actual pressures were reduced to the elevation of 1900 by small differential pressure corrections, so that the entire pressure system becomes homogeneous for the station.

During the years following 1900 a similar plan is to be followed, and all pressures will be reduced back to the standard elevation, so that the series will be maintained strictly comparable throughout the life of the station itself. There is great advantage in this procedure, for two reasons. It was found that in the other attempts to construct pressure normals the earlier computations were readjusted to the latest elevations at the different dates, thus obscuring the record and consuming a great amount of labor without arriving at final results. Also, the reduction tables to sea level, provided for the use of the stations, had to be renewed with every removal, which also consumed much time. On the new plan, however, each year's observations is added directly to a homogeneous station system, and the same reduction table serves without modification in consequence of any local changes. Indeed it is absolutely essential to reach such a basis of operation in meteorology as this, if there is to be made possible a scientific study of the secular variations of the weather, that is, the large problem of why and how the seasons, the climate, and the crops, differ from year to year, this being the next great problem awaiting practical meteorology. Evidently all the cosmical questions involving variations in the radiations of the sun must be compared with as definite a pressure system as this, if scientific results are to be secured from the meteorological data. It may be stated in passing, that in recent years, since the Government has erected large buildings in the cities of the United States, the Weather Bureau offices have been more permanently located, and that the average series of unbroken observations is growing longer than it used to be 10 and 20 years ago. At the same time the elevations are a little higher, because the offices are usually placed in the upper rooms of the lofty federal buildings.

OTHER CORRECTIONS TO THE STATION PRESSURES.

Besides reducing the observed pressures to an adopted station elevation it was necessary to make several more corrections in order to obtain a homogeneous system of normals. (1) The records were thoroughly inspected for the several corrections which ought to be applied to the barometer readings, and we have now a complete list of the barometer numbers and their errors for capilarity, scales, etc. Besides eliminating a few mistakes, there were two important special corrections to be applied. During the interval 1873–1878 a correction of 0.013 inch had been added to the Signal Service standard barometer to reduce it to the supposed Kew standard, but a system of comparisons instituted in 1877–78 showed that this was probably an error, and I have, therefore, removed it from the new series. A policy prevailed in the office from 1888 to 1898 to the effect that small errors could properly be neglected in the barometer reductions, and in accordance with it all corrections for scale error and capillarity smaller tnan ± 0.007 inch were discarded; these have now been all restored. (2) The correction to standard gravity, at sea level on the forty-fifth parallel of latitude, was applied during some years and omitted during others, so that there was irregularity in this respect. The gravity correction has now been systematically added by me since the beginning of 1873. (3) The hours of simultaneous observation have been changed several times since the opening of the service, but practically the observations can be grouped in two series of selected hours, 7 a. m., 3 p. m., 11 p. m., till June 30, 1888, and 8 a. m., 8 p. m. since that date. Referred to the mean of 24 hourly observations which is the natural standard to adopt for the world, these two systems present very different types of corrections for the North American Continent, and they must be reduced to some one system in order to be comparable. Accordingly auxiliary tables were prepared by which observations at a few selected hours could be reduced to the mean of 24 hourly observations, and the different series have been so corrected since January 1, 1873. These 24 hourly corrections will be applied in the future to all monthly and annual pressures published by the Weather Bureau, so that the fundamental system may remain intact in case other hours of observation should ever be adopted, differing from those now in use.

The application of the corrections for local elevation, scale error, capillarity, instrumental temperature, gravity, and diurnal variation, to the barometric readings, gives a smooth homogeneous system of values, from which the mean annual and the mean monthly station normals were derived and checked by cross addition; they are noted as B. From these the annual and the monthly variations from the general mean were obtained, and they have been thoroughly discussed in the Report of the Chief of Weather Bureau, 1900–1901, Vol. II. In order to determine our final station normals, B_n, it was further necessary to reduce all the short series to a standard fixed by the long 27-year series for a large number of stations sufficient to control the work. There are about two hundred and sixty-five stations, including the Canadians, to be dealt with, and of these about seventy-five had a long record of twenty-seven years. The run of the monthly residuals increases in irregularity as the number of years of observation decreases, but we have so managed the discussion that a short series normal can be reduced to the long series normal, and thus the station placed upon the standard basis. Whenever a new station is opened by the Weather Bureau a standard normal pressure can now be constructed by a brief computation, and the normal is more accurate than any that could be obtained by fifteen years direct observations, since these take up all the turbulent pressure fluctuations due to the general and local circulations, which it is impossble to eliminate, except by the use of the observations of many years. I may add that my experience with the barometric observations of the United States convinces me that they have always been of a high order of scientific excellence, and that the apparent residuals are not in fact due to accidental irregularities, but possess general and even cosmical significance when they are thoroughly discussed. It has been a mistake to assume that they are not worth the most exact treatment in the reductions; on the other hand there is every reason to believe that they will become of prime importance in the solution of several solar-terrestrial problems.

THE SEA LEVEL, 3,500-FOOT AND THE 10,000-FOOT PLANES OF REFERENCE.

Having obtained these reliable station pressures throughout the United States and Canada, the plateau problem now comes before us for discussion, in order to reduce the pressures taken at different elevations to the adopted planes of reference, in our case to the sea-level plane, to the 3,500-foot plane and the 10,000-foot plane. All the forecasting problems have been heretofore studied solely on the sea-level plane. But it seems evident that our grasp upon the weather problem will be greatly strengthened if we can study at least three sections through the atmosphere daily instead of the one at the bottom of it. I selected the 3,500-foot plane because this is the average height of the Rocky Mountain stations, to which the least possible reduction is required; also, because it is the average altitude of the base of the cumulus cloud sheet over the eastern districts, upon which observations can be most favorably made with theodolites for gradients of pressure, temperature, and vapor tension. Besides this, it is the altitude at which the moving currents of air are sufficiently distant from the ground to take on their natural configuration when freed from the surface turbulent friction. The 10,000-foot plane was chosen because it is already in use by the MONTHLY WEATHER REVIEW to show the monthly mean isobars at a considerable altitude. Furthermore, it is just in the midst of the most rapid-moving horizontal local currents, which build up the cyclones and anticyclones of the middle latitudes and upon which the intensity of storms depends. We know that the isobars on these three planes differ considerably from one another, the closed curves on the lower plane tending to open out into long sweeps on the upper plane, and it is probable that an intercomparison of these varying isobars from map to map will be valuable.

THE NEW REDUCTION PRESSURE TABLES.

It is evidently necessary to possess reduction tables of a perfectly general and flexible kind in order to make the necessary reductions from the several stations to these three planes, and from one plane to the other, in either direction upward or downward. As there are no such tables in print, I have first computed logarithmic reduction tables in English measures, similar to those in metric measures, described in the International Cloud Report of 1898–99, the intervals being for every 100 feet up to 10,000, and for every 10° F. from —40° to + 100°. From these general tables the special station tables were made, giving the corrections to be applied to the station pressure at intervals of 0.20 inch to reduce it to the three planes, respectively. These individual tables contain a correction for the humidity term separated from the dry-air term, a correction for the plateau effect, a residual reduction for a few stations, and two temperature arguments—first, the mean temperature of the air column, and second, the corresponding surface temperature, which is the mean value of two successive 8 o'clock observations, the last always including that hour for which the reduction is made. In order to simplify matters as much as possible for the observers on the stations, the individual station tables are constructed by combining all these corrections and applying them at short intervals of the station pressure, namely, for every tenth of an inch, and for such close intervals of the temperature argument that there shall be no interpolation necessary in this direction in order to obtain the hundredth of an inch of reduced pressure. The result is contained in three tables, one for each plane, with the surface temperature and station pressure as the arguments, and the reduced pressure to the three planes, respectively, in the body of the table, instead of the correction to the observed pressure. There is thus no computation to be done at the station to reduce the observation, and the time consumed in preparing this portion of the cipher code message is very short. The special tables for the stations for use in reduction to the 3,500-foot and the 10,000-foot planes are now being made up, the first and the second forms leading up to them being completed and checked. The tables for reduction to sea level are already in operation, and, so far as known, there is no occasion to modify the reductions at any of the stations. When one considers the large amount of painstaking and careful labor required to produce such a result as this in so complex a problem, it is a pleasure to commend the faithful work of Mr. Heiskell and Miss Hawkins, who have been my assistants in this computation. We hope to be able to make a trial of the working of the pressures on the higher planes before very long.

PREVIOUS DISCUSSIONS OF THE PLATEAU PROBLEM.

After all these preliminary matters have been concluded we may proceed to the really difficult portions of the work. They group themselves around three points, (1) the proper relation between the observed surface temperature, t, and the mean temperature of the air column, θ, corresponding to and substituted for the plateau at the regular intervals for which the general logarithmic reductions were computed; (2) the effect of the plateau itself upon the free air pressure; (3) the residual local effects which can not be classified with the other reductions. These will become clearer to the reader by briefly mentioning the previous methods which have been employed in reducing the plateau pressures to the sea-level plane. (1) From 1871 to June, 1881, the old Guyot tables were used in reducing low-level stations, with the surface temperature and pressure at the time of observation as the argument. Certain annual constants were employed in the cases of high stations. The effect was to cause the isobars to swing widely between the morning and evening hours, and generally the maps were very unsteady. (2) July, 1881, to June, 1886, monthly constants were used for each station, as recommended by the first board on barometer reductions; a single constant answered for each month; these are sometimes known as the Abbe-Upton constants. (3) July, 1886, to June, 1887, the entirely new system of tables by Professor Ferrel was used, thus introducing several valuable principles. Thus, the mean temperature of the preceding twenty-four hours was used instead of that belonging to the respective hours of observation; this was reduced by a vertical temperature gradient, 0.165 per 100 feet, to the approximate mean of the column; the pressure and temperature arguments (B, t) were both employed in entering the table; a special correction for the plateau effect was made in the form C, $\Delta\,\theta$, H, where C=0.00105, $\Delta\,\theta$ is the variation of the temperature from the annual mean, and H is the altitude in units of a thousand feet. The application of the correction for the plateau effect removes the wide range in pressure which occurs on the plateau between summer and winter and reduces it to about the same value on the plateau and in the low level eastern districts. For example, if the mean annual temperature is 50°, that for January 25°, and for July 80°, at a station 5,000 feet above the sea level, we have $0.00105 \times (-25) \times 5 = -0.131$ inch for January, and $0.00105 \times (+30) \times 5 = +0.158$ inch for July. The annual range for high stations on the plateau is about 0.400 inch, and on the low levels it is only 0.150, the difference being simply the plateau effect. Professor Ferrel's tables were not used very long. (4) July, 1887, to December, 1890, a mixture of Ferrel's and Hazen's tables; 1891–1901, Hazen's tables. Professor Hazen constructed a general empirical formula with the object of simplifying the form of the station table. For this purpose he assumed that Mount Washington is the type for the plateau reductions, which is in fact erroneous, since that isolated mountain acts like a free air point, except for the modified value of θ; he assumed that the sea-level pressure

should always be exactly 30.00 inches, and at the same time abandoned the pressure argument entirely, with all depending upon it, and computed the correction under these conditions; he rejected the plateau effect correction, and at the same time the change of surface temperature to the mean temperature, θ, was neglected. On applying this system to the daily map it was necessary to make certain arbitrary changes in the computed reductions in order to produce smooth isobars. The great simplicity in the use of this table, having only the surface temperature as argument, seems to have been considered sufficient ground for substituting these tables for Ferrel's, so that from 1891 till 1901, inclusive, they have been employed in making the daily weather maps, although well known to be unscientific and inaccurate. However, it should be said that although the plateau correction was omitted, the practical working of the Hazen method was such as to make the sea-level reductions conform much more closely to the Ferrel system than to the pure Laplacean system, which is correct for free air reductions only. On this account the Ferrel and the Hazen systems work in the same direction for wide departures of the temperature from the annual mean, and to some extent relieve the plateau exaggeration, so that we conclude that the weather maps have served fairly well for the practical purposes of forecasting. (5) 1895–1896, Professor Morrill, in connection with a second board on barometry, rediscussed the problem and computed a set of tables which have not been published, though they have been used for some office work, especially the construction of the sea level and the 10,000-foot plane maps for the MONTHLY WEATHER REVIEW during 1896–1901. The Laplacean free air reduction was computed by special tables for the pressure and the temperature arguments, the value of θ being found by certain adopted average vertical gradients varying for the different seasons of the year; the humidity term was made so as to modify the logarithmic argument; the plateau term was entirely omitted; the tables were in the form of a logarithmic argument, which was not very convenient for rapid work. It was suggested at the same time that a system of constants, daily rather than monthly, be resumed for making the necessary forecasting isobars.

BIGELOW'S SYSTEM OF BAROMETRY, 1902.

We now come to the sixth attack upon the problem, and shall here merely enumerate the steps in the discussion, while the report itself will be found in Volume II, Annual Report, Chief of Weather Bureau, 1900–1901. In substance the principles laid down by Ferrel have been adopted, but the work has been carried far beyond the degree of perfection possible to him nearly twenty years ago, in consequence of the numerous observations at our disposal, whereas Professor Ferrel contented himself with only four years of observation at the plateau stations preceding the time of his studies.

THE SEA-LEVEL TEMPERATURES.

The object to be obtained is to separate the temperature argument from the plateau effect, and to arrive at smooth isobars in correct relations to the winds and the weather throughout the Rocky Mountain region. Having prepared the monthly station pressure normals, as described above, the corresponding station temperature and vapor tension normals were extracted from the office records. The plateau is therefore to be considered as dotted over with 60 or 70 stations where the monthly values of the elements (B, t, e) are known. Assuming an average vertical temperature gradient of 0.30° per 100 feet, the temperatures were first reduced from those given at the station elevation, to corresponding values at selected heights, 500, 1,500, ... 6,500 feet, through short distances; for example, all between 0 and 1,000 feet were corrected to 500 feet, and so on. This concentrates the reductions on a few planes. Then a preliminary set of temperature gradients in latitude and longitude was computed from the temperatures on these few planes, throughout the region west of the Mississippi Valley. Certain *centers of reduction* were taken, namely, where the one hundred and twentieth meridian crosses the fiftieth, forty-fifth, fortieth, and thirty-fifth parallels of latitude, and the one hundred and tenth, one hundredth, and ninetieth meridians cross the same parallels, and the temperatures were reduced by the two horizontal gradients to these centers, so that a series of temperatures varying with the altitude are now known in vertical directions, at about 18 geographical points. These temperatures were plotted on a diagram whose abscissas are temperature values and whose ordinates are altitudes, one chart for each month and one for the year; average curves were drawn through the plotted temperatures and prolonged by best judgment to the sea level. In the majority of cases it was easy to do this, as the curvature was distinctly developed on the diagrams. In this way sea-level temperatures were found at several evenly distributed points beneath the plateau, and they were transferred to monthly charts on the sea-level plane, which were completed for the Pacific low level districts and for the central and eastern portions of the United States and Canada. A system of well graded isotherms was drawn through them for the entire country. Small adjustments of the temperatures on the centers of reduction were required to make the temperatures of the vertical system and of the horizontal system interlock harmoniously and agree together on the sea-level plane. Furthermore, new and more accurate temperature gradients in latitude and longitude could now be obtained, and the work was therefore repeated from the beginning to the end with the improved values. The adopted temperature system is the result of two or three such approximating computations, so that it has at last sufficient reliability to become the substantial basis for further reductions. The sea-level temperatures at the several stations can easily be scaled from these charts to the tenth of a degree, and such values are called t_0. The use of centers of reduction commends itself by the fact that the stations can be grouped in several ways, since the same station can be reduced to different centers, and the local inaccuracies will thus check themselves out; also by the fact that the entire amount of computation is much smaller and its accuracy can be controlled by the algebraic differences for uniform spaces. The most important result of this discussion is the development of well defined temperature inversions during the winter on the northern Rocky Mountain slope, and in the summer in the southern California districts. The former are due to the dynamic heating of the air blowing eastward over the Rocky Mountain divide, and the latter to the excessive surface heating of the arid region relatively to the temperature of the Pacific Ocean. The introduction of these inversion gradients relieves the congestion of the isothermal lines heretofore drawn in these districts.

THE FIRST PRESSURE REDUCTION TO SEA LEVEL.

Finally, the relative humidities were assumed to be the same for the surface and the sea-level plane throughout the plateau, and from the values of t_0 just found the corresponding sea-level vapor tensions, e_0, were computed. We have thus obtained all the elements required for a reduction of the surface pressure, B, to the sea-level pressure, B_0, by taking as a first approximation $\theta = \frac{t + t_0}{2}$ and the ratio $\frac{e_0}{B_0}$, where B_0 is nearly 30.00 inches for all monthly means. Using our new logarithmic tables, the monthly and annual pressure at each station in the United States and Canada was reduced to sea level, and the results were transferred to charts. Isobars were drawn through these sea-level pressures as accurately as

the data permitted, though the values of B_o were quite discordant in many places, and the lines somewhat in doubt. Of course the plateau correction was included in the sea-level reduction, as stated above.

TO FIND $t-\theta$.

For practical working by the tables, it was first necessary to determine the relations of t and θ for the entire range of temperatures throughout the year, and this was a task of no little perplexity. It was, however, finally accomplished by two processes. It will be remembered that in the Abbe-Upton system of monthly constants and in the Hazen empirical tables this modification of the surface temperature argument was omitted; that Ferrel used a constant vertical gradient of 0.165° per 100 feet for the year to pass from t to θ, and that Morrill modified this gradient by taking per 100 feet, 0.150° in winter, 0.200° in spring and autumn, and 0.250° in summer. My vertical temperature gradient came out about 0.195° for each month in the year, as the average for the entire plateau, but it was distinctly shown that the several portions of the plateau have very different gradients in the same month, and that for the same locality they change greatly from month to month. Hence it was improper to attempt to deal with the plateau as a whole by using the same temperature gradient; so that, in fact, each station must be considered not only by itself, but also in its relations to the neighboring stations. Finally, special curves have been constructed for temperatures between $-40°$ F. and $+100°$ F., showing the variable difference between t, the surface temperature for twenty-four hours, and the corresponding θ, or the mean air temperature of an air column substituted for the plateau itself. The θ can not be considered as the arithmetical mean temperature between the surface and the sea-level temperatures, because the connecting line is a curve and is not straight, so that it is essential to arrive at an integral mean temperature instead of an arithmetical mean. In a graphical construction the values of θ may be taken as the abscissæ and the differences, $t-\theta$, as the ordinates of a curve, which we seek to construct. The first approximation is evidently equal to $t-\theta=t-\frac{1}{2}(t+t_o)=\frac{1}{2}(t-t_o)$, but the true value may differ from this by several degrees at many of the high stations.

THE FIRST PROCESS.

We proceeded to discuss this point by two distinct methods, the first covering the low temperatures from $-40°$ to $+30°$, and the second covering the temperatures from about 10° to 90°, so that there shall occur a small overlapping of the two systems in the middle temperatures, and thus allow the two to be joined together. About fifty maps were selected for the winter season, when high pressures and low temperatures prevailed in the Rocky Mountain districts. The pressures for the plateau stations were next reduced to the 3,500-foot plane, because this requires the least average run for the corrections, and hence there is little error arising from selecting the wrong temperature arguments. This configuration of isobars was drawn in red lines; then the low stations near the Pacific Ocean and those in the Mississippi Valley were reduced to sea level; also some of the stations on the mountain slope at moderate elevations were reduced to the 3,500-foot plane as well as to sea level. A set of isobars was drawn on the sea level in blue lines. It was now assumed that the configuration on the 3,500-foot plane is substantially correct for that elevation, and is what the forecaster really wants at sea level for practical work. It was therefore joined with the sea-level system by simply making the red and blue lines flow together and uniting them smoothly; in other words, the upper configuration was depressed to sea level by simply renumbering the isobars in inches as determined by the true sea-level lines, so that a single system of well-balanced isobars covered the country. Next the question was, what is the value of θ that will be required to transform the observed station pressure into the sea-level pressure thus constructed? This was computed from the data in a reverse direction, and the differences, $t-\theta$, found; these were collected by groups for each station on the plateau above 1,000 feet in elevation; the means were taken and plotted as ordinates on the abscissa axis of θ. The result was very instructive, and it at once separated the plateau into groups corresponding to the geographical and climatic location, and showed that all the attempts to use one value of the vertical gradient for a given time is very erroneous. It should be remarked that the value of $t-\theta$ thus found was much too large, because it included within itself the real plateau effect, and this ought first to have been separated; but it gave true relative variations of $t-\theta$ with the range of temperature from $-40°$ to $+30°$, so that it was only necessary to discover the reduction factor to make the scale of values correct.

THE SECOND PROCESS.

For the warmer temperatures of the year, from $+30°$ to $+90°$, I took the mean monthly values of t and t_o, surface and sea-level temperature, respectively, and found $t-\theta=\frac{1}{2}(t-t_o)$ and $\theta=\frac{1}{2}(t+t_o)$. These were plotted month by month in coordinate points through which it was easy to draw approximate mean curves. It is noted that during the winter months the ordinates average a little larger for the same values of θ than during the summer months, but as we are limited to constructing a set of tables representing mean conditions, this mean line is the best that can be taken. The variation on the mean line does not often exceed $\pm 1°$, and this small change in the resulting argument has really but little influence upon the sea-level reductions which are required. Finally the slope of the second system of curves at the temperatures from $+10$ to $+30°$ indicated the slope that should be assigned to those found by the first method, that is, they gave us the scale factor for reducing the slope first obtained. The resulting curves are published in the full report, but they can hardly be described without diagrams. Generally speaking, on the north and east of the plateau the $(t-\theta)$ curves have a short ordinate from 10° to 40°, and a considerable increase toward either end; on the central portions of the plateau the curves are nearly flat, the length of the ordinates being about proportional to the altitude; on the western side of the plateau the curves have ordinates which are longest in the central parts and shortest at the ends, that is to say, they are about reversed in shape from those on the eastern plateau. These differing results are largely due to the climatic effects of prevailing winds from the Pacific Ocean, which blow upon the mountain ranges and precipitate their moisture on the western side; the clear skies and cold waves prevail on the eastern side; also there are seen to be certain dynamic heating effects. This subject is, however, too large to expand in this connection.

THE SECOND PRESSURE REDUCTION TO SEA LEVEL.

Equipped with these first approximate values of θ for each month as derived from the surface t, the reductions to sea level were made for the mean monthly normal station pressures, B_o, as already mentioned, and the corresponding isobars were drawn. The sea-level pressures, as shown by the resulting map itself, apart from the reduced values, are really more nearly well balanced and correct than those derived from the individual reductions, because the isobars depend upon the mean result of many neighboring stations, whose mutual claims must be simultaneously satisfied in drawing the pressure lines. The pressures were, therefore, scaled from the maps, giving B_m, and the differences taken between them and the original values as reduced by the computation for B_o-B_m. The outcome was ex-

ceedingly valuable and suggestive. For some stations the differences between the map and reduced values were such as to indicate only minor irregularities of a few thousandths of an inch, and these are to be referred to imperfections in the station normals; for others the difference was nearly constant, suggesting an error in the assumed elevation, especially for the old stations at military posts where the elevation had been derived from barometer readings; for others there was a very marked annual period in the differences, which could only be due to an error in the assigned value of the mean temperature, θ, since the differences disappeared at certain points, the signs being reversed between the low and the high temperatures. To be brief, all these sources of difference were removed, the entire work was recomputed a second time, a new system of isobars was drawn, and generally the entire subject was worked over in every available way. The practical effect was a readjustment of some elevations, and of the values of θ, so that the final differences between the map and the reduced sea-level pressures became small, usually less than one hundredth of an inch (0.010 inch), for the long record stations. In a few cases it was found that the constant error, called ΔA, was due to the fact that the initial temperature from which the plateau correction was computed, namely, $C \Delta \theta H$, was not accurately chosen. Usually this was taken as a mean annual temperature, but for some stations, especially on the southwestern edge of the plateau, Santa Fe, Flagstaff, Modena, Independence, etc., it should have been somewhat different. The variation can not be due to elevation, because this has been carefully determined by the surveys, but it must be caused by the local influence of the great desert in connection with the adjacent lofty mountain ranges. There are other stations of low elevation, lying in the eastern or in the Pacific coast districts, where no important error can arise from the reduction data, at which there is a small constant correction required to make the station harmonize with the others, as, for example, Lynchburg, Va., and Portland, Me. These stations have been known, at the Central Office, to act out of perfect harmony with their surroundings, and it is still difficult to understand the causes of these discrepancies. It has been found, furthermore, that the low stations on the north Atlantic and south New England coast and also on the north Pacific coast, are not so perfectly in accord as might be expected, and this may be due to the effect of some land and sea action which is operating in these localities. On the whole the reductions as completed are very reliable when all corrections are applied, that is to about 0.010 inch, under all possible circumstances. We note further that the differences outstanding between the finally adjusted reductions to sea level from the station normal pressures and the map pressures derived from the balanced system of isobars, can be properly considered as corrections to the station normals which will reduce them to the homogeneous or balanced normals. This is distinctly true for stations of short record, e. g., two or three years, where the monthly variations are really considerable, so that by applying these residuals as corrections the station normals are brought to agree with the more correct system which would be derived from a long record of observations. In short, since the long record stations really control the map construction, the short records can be at once improved by applying these small final residuals. Such residual corrections have, therefore, been added to all station normals, and the entire system is thus reduced to a long range homogeneous system and it is called B_n, normal pressure at the station, and B_m, normal pressure at the sea level. These values become our standard normals for further developements and have been so used in the remainder of the work. It is also evident that whenever a new station is opened, we can easily compute a more correct station normal pressure, by starting with the values of B_m as interpolated from the map, than could be found by less than fifteen or twenty years of observations.

PRESSURES COMPUTED ON THE 3,500-FOOT AND THE 10,000-FOOT PLANES.

We have now obtained the following quantities: At the stations, B_n, t, e, $R. H.$, normal pressure, temperature, vapor tension, and relative humidity; on the sea-level plane, B_m, t_0, e_0; also the ratio $\frac{e}{B}$ was computed for use in the reductions. It is next proposed to compute B_1, t_1, e_1, on the 3,500-foot plane, and B_2, t_2, e_2, on the 10,000-foot plane. For this purpose the temperature gradients in the free air must first be determined. There are three sources of information available, namely, the European balloon ascensions, the American kite ascensions, and the Washington gradients derived from computation on the cloud formations observed with the theodolites in 1896–97. These were all thoroughly discussed and they agree together sufficiently well to permit the assignment of average gradients from the surface to the two upper planes in the free air. The temperatures were computed on these planes for enough stations to permit drawing systems of isotherms with accuracy. As regards the 3,500-foot plane, the temperatures were found from the free air gradients for stations outside the plateau and of lower elevation than 3,500 feet; for points within the plateau the temperatures on that plane were taken from the diagrams of vertical temperatures, previously constructed; these two systems agree well together, and the isotherms are continuous. The isotherms on the 10,000-foot plane are simple curves joining the Atlantic and Pacific districts and present no trouble in crossing the plateau. There is one result of interest, however, at the surface of the plateau, which I call "gradient refraction." Within the plateau the vertical temperature gradient averages about 0.195° per 100 feet, and in the free air for the eastern districts about 0.300° up to 10,000 feet. Now it is evident that this plane is high enough above the plateau to escape the influence of the surface conditions, and that it is in the midst of the rapidly drifting current of air whose direction is eastward, so that quite uniform temperature must prevail along the same parallel of latitude. Hence, it follows that by using the smaller gradient 0.195° to the surface of the plateau, larger values than 0.300° must be employed from the surface to 10,000 feet, if the average gradient is to be about 0.300°, such as it would be if the plateau were removed. Therefore at the surface of the plateau there is something like an abrupt change in the gradients which is similar to refraction. Finally, by means of the temperatures thus found and the relative humidities, assumed to be the same as for the surface stations, the vapor tension on the 3,500-foot plane was computed. For the 10,000-foot plane it was assumed that the relative humidity is 50 per cent of the surface amount at all places; this may be subject to criticism, but it is near the truth and the effect on the vapor tension of even considerable changes in the relative humidity would be unimportant at the low temperatures prevailing at that altitude.

THE FIRST COMPUTATION OF B_1 B_2.

Instead of computing the values of t_1, e_1, and t_2, e_2, for the several stations at the outset, the work was much shortened by interpolating the values of all this data on selected points of the charts, namely, centers of reduction; that is, where the meridians 5° apart, 125°, 120° . . . . . . 65°, cross the parallels 5° apart, 55°, 50° . . . . . . 30°. On these centers of reduction the sea level B_m, t_0, e_0 were also drawn from the charts, so that the data is complete for reducing the sea-level pressures to the higher planes. There are two objects gained by this method of discussion; (1) the work of computation is shortened very much; and also (2) the result affords an admirable check on the entire system of reductions, as will be seen by what follows. The pressures B_1 and B_2 on the 3,500-foot plane

and the 10,000-foot plane, respectively, were computed by the logarithmic tables from the data thus obtained on the centers of reduction, and the corresponding systems of isobars were drawn. There now exists the same general harmony in these isobars as on the sea-level plane, and no further corrections are required. It is to be especially noted that in the plateau region the reductions from sea level to the upper planes were made by the same principles as if it had been a free air column, so that all plateau questions are laid aside.

THE SECOND COMPUTATION OF B_1, B_2.

From the B_1 and B_2 charts the pressures belonging to all the stations were interpolated, so that the values of B_1, B_2, to be derived by a direct computation from the station data could be compared as a check. Meanwhile the several station reduction tables to the three planes had been completed, and as a final check the three values, B_0, B_1, B_2, were computed and compared with the values derived from the charts, as explained in the first process. The differences between the two sets of values for B_0, B_1, B_2 were about the same on the three planes; they average about 0.010 inch, the majority being 0.000 or 0.010 inch, a few 0.020 inch, with occasional larger variations due to errors of computation readily detected, or to a local peculiarity, involving a slight readjustment of the corrections in the station tables. These checks, therefore, involved the three distinct parts of the entire discussion, since the process has been arranged practically in a circuit so as to pass from the station B_n to B_1 and B_2 by two separate routes, as described. Hence, (1) the processes of eliminating the plateau effect, and of computing the temperature arguments t and θ were successful; (2) the logarithmic tables and the numerical station tables are in agreement; (3) the charts are accurately drawn, and represent the observations with precision.

As the result of this discussion we have prepared charts for the United States and Canada, giving the monthly and annual normals of pressure, temperature, and vapor tension on the sea-level plane, the 3,500-foot plane, and the 10,000-foot plane, also the relative humidity on the sea-level plane, i. e., 130 charts for these data. There are also charts of gradients of temperature in latitude, in longitude, and in altitude; and charts of pressure variations for a few selected hours referred to the mean of 24 hourly observations. Furthermore, the corresponding numerical values are entered in a summary table for all stations on the sea-level plane, about 265 in number; also for all the stations which were in use by the Weather Bureau, either in the United States, Canada, and the West Indies, at the beginning of the year 1900, or which have been opened for service since that date, making about 175 on the upper planes.

It has not been found necessary to revise any of the reductions to sea level since the tables were put in operation on January 1, 1902, showing that they bear the test of practical work at the hands of many observers. The station tables for the upper planes will soon be tried, and an estimate made as to their value in increasing the accuracy of the forecast system of the Weather Bureau.

We conclude with the remark that the pressure observations and computations of the United States have been at last placed upon a strictly scientific basis, and that all the corrections required by theory will be systematically applied in the future, and the entire series from 1873 onwards will be kept strictly homogeneous. We shall, therefore, for the first time be ready to take up the problems of seasonal variation of the weather, the changes of the climate and crop from year to year, and also the true cosmical problems involved in the radiation effects of the sun upon the earth's atmosphere. Even if we do not ourselves succeed in resolving these questions, we shall have left this portion of the data in form for others to make reliable discussions.

THE TERM INDIAN SUMMER.[1]

By ALBERT MATTHEWS, Boston, Mass., dated December 15, 1901.

However much we Americans may abuse our ever changing climate,[2] there is at least one portion of the year upon which we unite in lavishing praise. It need scarcely be said that I allude to that highly indefinite but always delightful period known as the Indian summer. Connected as this season is, both by name and in popular belief, with the aborigines, it would seem as if the name itself must be of some antiquity; yet, so far as my observation goes, it is not until the year 1794 that the expression Indian summer occurs at all, and not until the nineteenth century that it became well established. If the term is, in fact, barely more than a century old, it would again seem as if we ought to be able to trace out its origin with some certainty. Yet such is far from being the case.

It is proper to define the scope of this paper. In a little more than a century there has grown up, as will soon be abundantly proved, a popular belief that there occurs in our autumn a spell of peculiar weather, and to this has been given the name Indian summer. It has been stated that this spell appears in September; that it comes in October; that it occurs in November or not at all; that it takes place in January; that it lasts for three or five days only; that it extends over a period of more than four weeks; that it is peculiar to New England; that it does not occur in New England at all; that it is now more marked than was formerly the case; that in former years it was more pronounced than it is now; that it has at present ceased to occur anywhere. Amid these various and conflicting assertions, it is not easy to arrive at any definite conclusion; but, eliminating the points in regard to which there is divergence of opinion, it is tolerably clear that this supposed spell of peculiar weather is characterized by three special features—by a warmth greater than that of the few days or weeks immediately preceding, by smokiness, and by haziness. It is true that some scientific writers have denied the existence of the increased warmth and have declared that the alleged smokiness is an optical illusion.[3] But the popular belief—and it is

[1] During the past ninety years much has been written about this term, but until now no attempt has been made to give its history in detail or to collect and examine critically the explanations that have been advanced as to its origin. The term is not found in Webster's Compendious Dictionary (1806), nor in his American Dictionary (1828), nor in his Letter to the Hon. J. Pickering on the Subject of his Vocabulary (1817); nor in J. Pickering's Vocabulary or Collection of Words and Phrases, which are supposed to be peculiar to the United States (1816); but it was recognized in the 1841 edition of Webster. Its history was first indicated in the Oxford Dictionary (1900), and some of the extracts there quoted are also given in this paper. Lest it be thought that I have taken these without acknowledgement, I may be permitted to add that of the nine extracts previous to 1883 quoted by Dr. Murray all but one (from De Quincey, dated 1830) were furnished by me.

My attention has been directed to the term for more than twelve years, and this paper is based on material collected during that period. I am, however, indebted to Prof. Cleveland Abbe for turning over to me the extracts and correspondence in his possession; to the editors of the Dial, the Journal of American Folk-Lore, the Nation, and the New England Historical and Genealogical Register for inserting queries in their journals; and to various correspondents for replying to appeals for information. Wherever this has been obtained and used, due acknowledgment is made in the notes.

[2] In 1789 Dr. Rush said: "Perhaps there is but one steady trait in the character of our climate, and that is, it is uniformly variable." (American Museum, 1790, vii, 334.)

Rush was speaking of Pennsylvania, but his remark is equally applicable to the country at large. The sudden and violent changes which occur in our temperature have for three centuries been a favorite subject of comment.

[3] In 1833 a Baltimorean wrote: "Again this redness of the air together with the mechanical irritation produced by the denseness of the aerial vapor, excites a painful affection of the eyes—this sensation, connected with the smoky appearance of the sky, induces great numbers of the inhabitants of this country to believe that the Indian summer consists of a smoky state of the air produced by burning the vegetable decidua which are collected together in the fall season for this purpose, or as

with this only that I am concerned—appears to be such as I have described. I do not enter into the question whether this supposed spell of peculiar weather does actually occur, or whether it is rather a delusion like the popular belief that the weather is affected by the changes in the moon.[4] I merely take the term Indian summer as a literary term which gives expression to the popular belief, and my concern is solely with the history of this literary term and with the explanations which have been advanced to account for it.

The statement already made that the term Indian summer itself is unknown until 1794,[5] and the further statement that allusions to the Indian-summer season under any name whatsoever appear to be unknown until late in the eighteenth century, will doubtless cause surprise and arouse opposition; for they are in direct conflict with popular belief and with many assertions to the contrary. As long ago as 1804, C. B. Brown declared that the season was "predicted by the natives to the first emigrants." In 1809 Dr. Ricketson said that the name Indian summer "had long been known in this country." In 1842 J. F. Watson asserted that the season was so called by "the white inhabitants, in early times." In 1872 W. Flagg spoke of the "peculiar phenomena described by some of our early writers both in prose and verse." In 1873 T. B. Maury declared that "the first explorers of America noted the Indian summer."[6] In 1887 Bela Hubbard stated that the season was spoken of by "early New England writers."[7]

It is thus seen that for nearly a century people have been asserting that the term Indian summer was known to and employed by our early writers.[8] But it will be observed that no one has yet placed his finger on a single passage where the term occurs in early writings. Those who make a positive statement are bound to adduce evidence in its support, and their failure to do so may be taken as an indication that the required evidence does not exist. On the other hand, it is proverbially difficult to prove a negative, and all I can be expected to do in the circumstances is to give specific references to passages in which there are allusions to climate, so that the reader can at his leisure, if so disposed, ascertain for himself exactly what writers on America have had to say on the subject.

Of the seventeenth century writers, some make no allusion at all to climate, while others occasionally indulge in an observation about the weather, but can not be said to discuss climate.[9] In general, however, at least some brief remark about climate—or, as many authors were fond of calling it, the "air"—was thought proper, and the works in which such discussions occur are numerous.[10] In the eighteenth century

some will have it the firing of the neighboring mountains. This appearance of actual smoke is however an optical illusion, produced by the foggy appearance of the air, and which seems to find confirmation by the great irritation of the visual organs, effected by the excess of red rays, etc." (American Journal of Science, 1835, xxvii, 147.)

In 1835 Dr. L. Foot wrote: "As to the *increased* temperature, during Indian summer, we can not agree to it. From the document we have quoted, (Meteorological register,) it appears, that the mean temperature for November, is somewhat lower than that of October. It is from the quiet placid state of the atmosphere, that some are led to suppose that it is actually warmer. But he who keeps an accurate record of the thermometer will find it is a mistake." (Ibid., 1836, xxx, 12.)

[4] Sir Robert S. Ball writes: "We owe much to the moon. We hope, indeed, in a subsequent chapter to point out that we owe a great deal more to her than was formerly suspected; but there is one widely-credited myth about the moon which must be regarded as devoid of real foundation. The idea that the moon and the weather are connected has no doubt been entertained by high authority, but careful comparison has shown that there is no definite connection between the two." (Story of the Heavens, 1886, pp. 59, 60.)

[5] By this I mean that no example before 1794 has ever been adduced. That the term was in use earlier, is possible; but if so, the fact has not yet been discovered.

[6] Mr. Maury's words are: "The first explorers of America noted the Indian summer, and ever since it has excited the poetic fancy as well as the philosophic inquiry of many minds. Palfrey, the distinguished historian of New England, and Thomas Jefferson, in his History of Virginia, have not forgotten it is one of the most fascinating features of American climate."

Mr. Maury then goes on to quote from Palfrey a passage which will be given later in our text (under date of 1859), and observes:

"This testimony, which was borne by other colonial annalists, agrees with the present facts, and shows the identity of this meteorologic wonder with that of the 'Old Men's Summer' of Germany, 'St. Martin's' of France, and a similar one, which has been remarked by one or two historians, of Mexico."

This remark conveys the impression either that Palfrey was a "colonial annalist," or that he is alluding to colonial times. Palfrey wrote only a little more than forty years ago, he is discussing the climate of his own time, and what he says naturally "agrees with present facts" because he is dealing with present facts.

Jefferson, in his notes on Virginia (1782), to which Mr. Maury doubtless alludes, devoted Query VII to climate (pp. 134–151, in Ford's edition of Jefferson's writings, iii, 177–187). Mr. Maury's statement that Jefferson had "not forgotten * * * one of the most fascinating features of American climate" is very wide of the mark, inasmuch as Jefferson's chapter does not contain a syllable that by any ingenuity can be twisted into an allusion to the Indian summer. A little later Mr. Maury quotes an article by "an early writer," but this article was written in 1833 and printed in 1835. Finally, the German name for the season is not "Old Men's Summer," but "Altweiber sommer." Mr. Maury's article will be found in Harper's Magazine for December, 1873, xlviii, 89–98.

[7] It is worth while to give Mr. Hubbard's statement in full: "Early New England writers speak of this serene portion of autumn as peculiar to America, hence the name they gave it. But we look in vain for any recognition of it in pages not more than half a century old" (Memorials of a Half-Century, p. 558).

If Mr. Hubbard had met with no recognition of the term before 1837, he certainly could not have found it mentioned by early New England writers. On the other hand, if he had actually seen the term used by early New England writers, he must have encountered it before 1837. In short, Mr. Hubbard's second sentence flatly contradicts his first.

[8] These erroneous assertions are doubtless due to two causes: First, to ignorance of American writings of the seventeenth and eighteenth centuries; and secondly, to that looseness of statement to which we are all only too prone. An admirable illustration of the same process is furnished by a passage in one of Cooper's novels. The most popular theory in regard to the derivation of the word Yankee is that Yankee is a corruption of Yengees, itself a corrupt pronunciation by the Indians of the word English. Alluding to this theory, Cooper remarked in 1841:

"Nearly all the old writers, who speak of the Indians first known to the Colonists, make them pronounce the word 'English' as 'Yengeese.'" (The Deerslayer, i, 230, note.)

It is not often that one is able to point to the first printed appearance of a word in the language, but in the present instance this can be done. The word Yengees was first used, and the Yengees theory was first advanced, by the Rev. John Heckewelder in his Account of the History, Manners, and Customs of the Indian Nations, a work published in 1819. The word Yengees, then, at the time Cooper declared that it was known to "nearly all the old writers," had been before the world precisely twenty-two years.

[9] Among such works seem to be the following: Capt. J. Smith, True Relation, 1608; Capt. J. Smith, Description of New England, 1616; Capt. J. Smith, New Englands Trials, 1620; T. Morton, New English Canaan, 1637; Capt. E. Johnson, Wonder-Working Providence, 1654; G. Alsop, Character of the Province of Mary-Land, 1666; N. Morton, New England's Memorial, 1669; J. Josselyn, New-Englands Rarities Discovered, 1672; J. Dunton, Letters from New England, written in 1686.

[10] Among these are the following: 1609, Nova Britannia, p. 11 (Force's Tracts and Other Papers, i); 1612, Capt. J. Smith, Map of Virginia, Works (Arber), pp. 47, 48, 344; 1621, E. Winslow, in Mourt's Relation, 1622, p. 62; 1624, E. Winslow, Good News from New England, in Arber's Story of the Pilgrim Fathers, 1897, pp. 593, 594; 1629, F. Higginson, New-Englands Plantation, 1 Massachusetts Historical Collections, i, 120, 121; 1630, Planters Plea, p. 13, (Force's Tracts and Other Papers, ii); 1634, W. Wood, New Englands Prospect, 1865, pp. 3–11; 1642, T. Lechford, Plain Dealing, 1867, p. 114; 1643, R. Williams, Key into the Language of America, pp. 82–85; 1644, J. Megapolensis, in E. Hazard's Historical Collections, 1792, i, 519, 520; 1666, Brief Description of the Province of Carolina, in B. R. Carroll's Historical Collections of South Carolina, 1836, ii, 13, 14; 1670, D. Denton, Brief Description of New York, 1845, pp. 16, 18, 19; 1674, J. Josselyn, Account of Two Voyages to New-England, pp. 54–58; 1680, W. Hubbard, General History of New England, 1815, pp. 19–21; 1682, T. A., Carolina, in B. R. Carroll's Historical Collections of South Carolina, ii, 62, 63; 1682, Account of the Province of Carolina, in Carroll, ii, 23, 25, 26; 1685, T. Budd, Good Order Established in Pensilvania & New-Jersey, 1865, p. 29; 1688, J. Clayton, in Philosophical Transactions, 1693, xvii., 784–789; 1695, J. Miller, Description of the Province and City of New York, 1848, pp. 7, 8; 1698, G. Thomas, Historical and Geographical Account of the Province and Country of Pensilvania, pp. 7, 8; 1698, G. Thomas, Historical Description of the Province and Country of West-New-Jersey, p. 20; New York Colonial Documents, i, 14, 40, 179, 180, 275,

there were also some writings from which allusions to climate were absent,[11] but, as a rule, the allusions were frequent.[12]

The voyages of the early explorers to America were followed with interest in England, but when this country became permanently settled and the colonies firmly established then public attention in England was diverted. The ignorance and the neglect shown by the mother country, however advantageous they may have been politically in permitting the colonists to work out their own institutions, wounded the *amour propre* of the Americans, and in the eighteenth century became the subject of animadversion. In a letter written from England July 7, 1773, Franklin said:

"The great defect here is, in all sorts of people, a want of attention to what passes in such remote countries as America; an unwillingness to read anything about them if it appears a little lengthy, and a disposition to postpone the consideration even of the things they know they must at last consider, that so they may have time for what more immediately concerns them, and with all, enjoy their amusements and be undisturbed in the universal dissipation."[13]

No sooner, however, had the colonies achieved their independence, than the new nation at once became the object of great interest to Europeans in general and to Englishmen in particular. Over they came in large numbers to view our country, and to study our political, social, and moral conditions; and in the last quarter of the eighteenth century began that stream of British and foreign travelers, each with his book about "the States," which has never ceased to flow. No less remarkable was the change in ourselves. Of political activity there had never been a lack in this country, but hardly had the Revolutionary war come to a close than a great stimulus was given to historical studies, and book after book devoted to American history issued from the press. Nor was this activity confined to historical studies alone, but manifested itself in many lines of intellectual research.[14] Now in the histories and books of travel by and about ourselves, there was scarcely a subject which elicited greater interest than that of climate. Discussions became more frequent and more elaborate, and a favorite topic for debate was the alleged change in climate which had taken place in America; some stoutly maintaining that this change had been toward mildness, while others as strenuously urged the opposite view.[15] It so happens, then,

276, 612, iv. 274, ix, 30; Jesuit Relations and Allied Documents, ii, 201, iii, 47-61, xxii, 41, xxxviii, 221-227, xliii, 261. In such of the Jesuit Relations as I have myself read there is no allusion to the Indian summer; and Mr. R. G. Thwaites, the editor of that great work, writes me that "the term 'Indian Summer' does not appear, so far as I can see, to have been used in Canada during the period covered by the Jesuit documents."

[11]Among these are the following: State of Trade in the Northern Colonies considered; with * * * a particular Description of Nova Scotia, 1748; L. Evans, Analysis of a General Map of the Middle British Colonies, 1755; W. Smith, History of the Province of New-York, 1757; T. Hutchinson, History of Massachusetts, 1764, 1767, 1780; S. Smith, History of the Colony of Nova-Cæsaria, or New-Jersey, 1765; J. Bartram, Journal, 1765-1766, in W. Stork's Account of East-Florida; J. Carver, Travels through the Interior Parts of North America in the Years 1766, 1767, and 1768; D. Ramsay, History of the Revolution of South-Carolina, 1785; Voyages de M. le Marquis de Chastellux dans l'Amérique Septentrionale Dans les Années 1780, 1781, & 1782 (published in 1786); J. Lorimer, Account of the Surveys of Florida, 1790; W. Bartram, Travels through North and South Carolina, Georgia, East and West Florida, 1793; J. Drayton, Letters written during a Tour through the Northern and Eastern States of America, 1794; B. Trumbull, Complete History of Connecticut, 1797, 1818; J. A. Graham, Descriptive Sketch of the Present State of Vermont, 1797; Tour through Upper and Lower Canada, 1799; Hannah Adams, Summary History of New-England, 1799.

[12]Among these are the following: 1701, C. Wooley, A two Years Journal in New-York, 1860, pp. 22-26; 1702, T. C. Holm, Description of the Province of New Sweden, 1834, pp. 55-60; 1705, R. Beverley, History and Present State of Virginia, Book iv, pp. 59-68; 1707, J. Archdale, New Description of that Fertile and Pleasant Province of Carolina, in B. R. Carroll's Historical Collections of South Carolina, ii, 96; 1721, Charlevoix, Histoire et Description Générale de la Nouvelle France, 1744, v, 241-250; 1733, New and Accurate Account of the Provinces of South Carolina and Georgia, in Collections of the Georgia Historical Society, i, 49, 50; 1735, New Voyage to Georgia, in Collections of the Georgia Historical Society, ii, 41; 1741, Impartial Inquiry into the State and Utility of the Province of Georgia, in Collections of the Georgia Historical Society, i, 157, 518; 1744, A. 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Stork, Account of East-Florida, pp. 39-43; 1768, Histoire Naturelle et Politique de la Pensylvanie * * * * * Traduit de l' Allemande, pp. 39-45, 320-353; 1769, J. Knox, Historical Journal of the Campaigns in North-America for the Years 1757, 1758, 1759, and 1760, ii, 462, 463; 1769, A. Cluny, American Traveller, pp. 33, 36, 56, 103; 1770, H. Williamson, Attempt to account for the Change in Climate, which has been observed in the Middle Colonies in North-America, in Transactions of the American Philosophical Society, i, 336-345; 1775, A. Burnaby, Travels through the Middle Settlements, in North America, In the Years 1759, and 1760, pp. 8, 9, 67, 79, 100, 108, 120, 135, 151, 155; 1776, L. Chalmers, Account of the Weather and Diseases of South-Carolina, i, pp. 8-28, 33, 34, 41-46, 220, 221, ii, 55-57, 200; 1778, T. Hutchins, Topographical Description of Virginia, Pennsylvania, Maryland, and North Carolina, pp. 13, 15; 1779, A. 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Brissot de Warville, Nouveau Voyage dans les États-Unis de l' Amérique Septentrionale, Fait en 1788, i, 374-376, ii, 118-129; 1792, G. Cartwright, Journal of Transactions and Events, during a Residence of nearly Sixteen Years on the Coast of Labrador, iii, 232; 1792, J. Belknap, History of New Hampshire, iii, 17-30; 1794, S. Williams, History of Vermont, pp. 42-65; 1795, J. Sullivan, History of the District of Maine, pp. 6-9; 1795, S. Hearne, Journey from the Prince of Wales's Fort in Hudson's Bay, to the Northern Ocean, Undertaken * * * In the years 1769, 1770, 1771, and 1772, pp. 2, 7, 27, 203, 204, 206; 1795, T. Cooper, Some Information Respecting America (second edition), pp. 9, 10, 11, 16, 17, 20, 24; 1799, I. Weld, Jr., Travels through the States of North America and the Provinces of Upper and Lower Canada during the years 1795, 1796, and 1797 (second edition), i, 96, 97, 112, 247-252, 389, 390, 398; 1796, W. Winterbotham, Historical, Geographical, Commercial, and Philosophical View of the United States of America, i, 79-83; R. Proud, History of Pennsylvania, ii, 238-242; 1798, I. Allen, Natural and Political History of the State of Vermont, pp. 9-12; 1799, La Rochefoucault Liancourt, Voyage dans les États-Unis d'Amérique, Fait en 1795, 1796 et 1797, iv, 50-56, 176, 177, 192, viii, 117-125; 1799, N. Webster, Dissertation on the Supposed Change in the Temperature of Winter, in Memoirs of the Connecticut Academy of Arts and Sciences, 1810, i, 1-68 (also in Webster's Collection of Papers on Political, Literary, and Moral Subjects, 1843, pp. 119-162); 1800, E. Oliphant, History of North America and its United States, pp. 17, 20, 21, 108, 109, 197, 198, 298, 299, 324, 346, 378; New York Colonial Documents, viii, 435, x, 230; Transactions of the American Philosophical Society, i, 32, 322, 336-345, ii, 118-158, iv, 224-226, vi, 9-23, 43-55; Memoirs of the American Academy of Arts and Sciences, i, 336-371, ii, 65-92; American Museum, v, 151, 152, 229-233, 244, 245, vi, 25-27, 250-254, vii, 36-39, 333-340, viii, 149, 195, 247, x, 159, 207, 259, xii, 191, 255; Medical Repository, i, 99-104, 245-247, 373-375, 530, ii, 101-103, 205-207, 319-321, 376, 377, 429, 430, vi, 9-16. Some of the magazines contained monthly "meteorological observations."

[13]Works (Bigelow), v, 190.

[14]As proof of this there is need only to mention the founding of the Massachusetts Historical Society; the Transactions of the American Philosophical Society, and the Memoirs of the American Academy of Arts and Sciences; the poems of Barlow, Dwight, and Freneau; the novels of Charles Brockden Brown; the publication of monthly magazines like the American Museum, the Boston Magazine, the Columbian Magazine, the Massachusetts Magazine, the New York Magazine; a special journal such as the Medical Repository; and the formation of local societies of a historical, antiquarian, or literary nature.

[15]A layman will wisely refrain from striking a balance between the

that just before 1800 the literature of the subject of climate had reached more than respectable proportions, and the places where one would naturally expect to find allusions to the Indian-summer season are somewhat embarrassing from their number. It is pertinent to our subject to make some extracts from books published shortly before 1800, and these may well begin with three passages of an earlier date. In 1705 R. Beverly, writing of Virginia, said: "But the spring and fall afford as pleasant weather as Mahomet promis'd in his Paradise."[16]

Describing the climate of New York, Cadwallader Colden wrote in 1723: "The fall in this country (and all over the main of America) is most agreeable from the beginning of September to the middle of November The weather being mild and dry The Sckie always serene, and the People healthy."[17]

Again, in February, 1737–38, the same writer observed: "The fall of the leaf is the most pleasant season in this country. from the beginning of September to december we have moderate weather with a serene sky, the horison being seldom cover'd with clouds in that time."[18]

In 1775 Governor Pownall wrote: "The Climate of the Continent at large, or rather of that Portion of North America which is contained within the Limits of this Map, may be thus stated.

"Its Seasons are Summer, Autumn, or what the Americans more expressively call The Fall, and Winter. The Transition from the Locking up of all Vegetation in Winter to the sudden Burst of it again to Life at Beginning of the Summer, excludes the progressive Season which in the more moderate Climate of Europe we call Spring.

"The Season begins to break soon after the Fall of the Leaf, and temporary cold Rains and Sleets of Snow fall in November, the North West Winds begin, and towards Christmas Winter in all its Rigour sets in. * * * About the Middle of September the Mornings and Evenings begin to grow cool, and from that time to the Beginning of the Winter Season it is the Climate of Paradise."[19]

Of the climate of Pennsylvania, Dr. Benjamin Rush remarked in 1799: "The autumn is the most agreeable season of the year in Pennsylvania. The cool evenings and mornings, which generally begin about the first week in September, are succeeded by a moderate temperature of the air during the day. This species of the weather continues with an increase of cold scarcely perceptible, till the middle of October, when the autumn is closed by rain, which sometimes falls in such quantities as to produce destructive freshets in the rivers and creeks, and sometimes descends in gentle showers, which continue with occasional interruptions by a few fair days, for two or three weeks. These rains are the harbingers of the winter, and the Indians have long ago taught the inhabitants of Pennsylvania, that the degrees of cold during the winter, are in proportion to the quantity of rain which falls during the autumn."[20]

In 1792 J. Belknap said of New Hampshire: "Light frosts begin in September; in October they are more frequent, and by the end of that month, ice is made in small collections of water; but the weather is mostly serene. November is a variable month, alternately wet and dry."[21]

In 1794 S. Williams remarked of Vermont: "From the beginning of September until the middle of October we have commonly the most agreeable season, with moderate westerly winds, and a clear sky. The latter part of October and November, are generally cold, wet, and uncomfortable; attended with frequent rains, some snow and high winds."[22]

In 1796 I. Weld, Jr., an English traveler, observed: "The months of October and November are the most agreeable in the middle and southern states, of any in the year; the changes in the weather are then less frequent, and for the most part the air is temperate and the sky serene."[23]

In 1798 R. Proud contented himself with remarking that in Pennsylvania "the autumn" is "long and mild."[24]

To continue these extracts and references, in an attempt to be exhaustive, would be both tedious and unnecessary. Those previously given cover every portion of North America into which English speaking people had penetrated before 1800, either as explorers, travelers, or settlers. The present writer finds it difficult to detect in these passages any deeper meaning than the simple statement that our weather in autumn is pleasant. Of increased warmth, of smokiness, of haze,[25] three features which, as already remarked, are in the popular mind the distinguishing characteristics of the Indian summer, of these, there is not so much as a hint.[26] I have dwelt at some length upon the writers of the period just before 1800, because it was at this very time that the term Indian summer came into use and the alleged phenomena of the Indian-summer season came to be noticed. The fact, therefore, that so many writers previous to 1800 neither employed the term nor recognized the season, is singular, significant, and noteworthy.[27]

While at Le Bœuf, a few miles from the present city of Erie, Pa., Major Ebenezer Denny made this entry in his Jour-

opposing arguments, but he may be permitted to think that a remark made a half century ago by John C. Gray is very much to the point, and applies as well to the country at large as to New England. "It has been a general, and is perhaps still a prevailing impression among the inhabitants of New England, that our climate is much warmer now than two hundred years since. This position has been distinctly assumed by some of our best historians and naturalists, and many ingenious reasons have been given for the change. The explanation which seems to have met with most favor is that which ascribes the alleged softening of the winter's cold to the clearing away of large tracts of forest trees. It is believed, however, that the position itself may be fairly called in question, and that philosophers, by a mistake not unprecedented in the observers of natural phenomena, have employed themselves much more diligently in accounting for a striking phenomenon which they have assumed to exist, than in collecting precise evidence to determine the fact of such existence." (In First Annual Report of the Secretary of the Massachusetts Board of Agriculture, 1854, p. 147.)

[16] History and Present State of Virginia, Book iv, p. 63.

[17] New York Colonial Documents, v, 692.

[18] Ibid., vi, 123.

[19] Topographical Description of such Parts of North America as are contained in the (annexed) Map of the Middle British Colonies, 1776, p. 44. Pownall also says that "the Season of hazy, foggy, and rainy Squalls from North East begins towards the latter End of April in some Parts, towards the Beginning of May in others;" but does not allude to smoke or haze in the autumn.

[20] Account of the Climate of Pennsylvania, in American Museum, vi, 252. This Account was issued in a pamphlet in 1789, and was reprinted in the American Museum, vi, 25–27, 250–254, vii, 333–340.

[21] History of New Hampshire, iii, 16. Belknap also says: "From the middle of September the mornings and evenings begin to be so chilly, that a small fire becomes a desirable companion. In October the weather requires one to be kept more steadily; from the time that the autumnal rains come on in November it is invariably necessary to the end of March."

[22] Natural and Civil History of Vermont, p. 55. It will not escape notice that, according to Rush, Belknap, and Williams, the months of October and November were regarded as rainy months, or when rain might be expected.

[23] Travels, 1799, second edition, i, 96.

[24] History of Pennsylvania, ii, 238.

[25] Allusions to smoke or haze before 1800 are rare in the extreme. In 1798 R. Proud, speaking of the northwesterly winds, said:

"These winds seldom fail to produce a clear sky, and a remarkable sharp cold, even, in every season of the year; as those from the southwesterly are distinguished for producing haziness and warmth or heat in summer. But the eastern winds are frequent, and as much observed to bring on haziness, fogs, or clouds, and wet or falling weather, as the former are, for their respective cold and heat, with their peculiar dryness." (History of Pennsylvania, ii, 238, 239.)

There is here nothing about haziness being peculiar to the autumn months.

[26] Quite possibly these passages will strike a meteorologist in an altogether different light; but I of course speak as a layman, and with the popular belief in mind.

[27] For many years after 1800 the discussions on climate continued with unabated zeal. Among works between 1800 and 1820 in which neither the term nor allusions to the Indian summer occur, are the following:

nal on October 13, 1794: "Pleasant weather. The Indian summer here. Frosty nights."[28]

Writing from Hartford, Conn., June 7, 1798, Dr. Mason F. Cogswell, said: "The weather here has been somewhat peculiar. I will endeavour to sketch some of the most prominent features of the season. Our first winter month (December) was uniformly cold, and most of it severely so; and, as the ground was wholly uncovered with snow, the frost penetrated to an unusual depth in the earth, generally from two to three feet. About the beginning of January the weather softened considerably, and continued mild for several days. Most people supposed the Indian Summer was approaching (a week or fortnight of warm weather, which generally takes place about the middle of January), but, instead of this, there succeeded to these pleasant days a delightful fall of snow, about a foot in depth, which was bound down by an incrustation of hail, and prevented from blowing in heaps by the winds which followed."[29]

Volney, the noted French traveler, who visited this country between 1795 and 1798, remarked in 1803: "Une seconde crise arrive du 15 au 20 octobre, c'est-à-dire, quand le soleil s'est déjà avancé de 20 à 25 degrés au sud de l'équateur.

* * * * * * * *

Les vents de nord-est et de nord-ouest deviennent plus fréquens; le sud-ouest perd de sa vigueur et décline vers l'ouest; l'air devient plus frais, mais le ciel reste clair; le soleil est toujours chaud au milieu du jour, et vers novembre, reparaît une série de beaux jours, appelés l'été *sauvage* (*Indian-summer*): c'est ce que nous appelons en France l'été de la Saint-Martin; mais il est devenu si rare et si court, que nous n'en parlons plus que par tradition."[30]

Thomas Ashe, an Englishman who traveled in this country, said, under date of July, 1806: "In regard to the climate, the winter is mild; snow and frost seldom continue above three or four weeks; the spring is dry, interrupted only by the necessary refreshment of occasional showers; the summer is not violently hot, being tempered by a perpetual breeze; and the autumn is distinguished by the name of the Second Summer. Controuled by these facts the public cry is that Kentucky *must* be healthy, that, enjoying such a climate, it can not be otherwise, and that no country of the globe can boast of such salubrity and such an atmosphere."[31]

In 1809 Dr. Shadrach Ricketson, alluding to New York, observed: "The two last autumnal months exhibited nothing very unusual, being attended with frequent alternations of frost and rain. In the last was a course of dry, smoky weather, long known in this country by the name of 'Indian summer.'"[32]

In 1813 H. G. Spafford wrote: "The Indian-Summer, a peculiar and elegant feature of an American autumn, in connection with the splendid and rich variety of tint assumed by the forest foliage at that season, commences usually about the last of October, and extends into December with occasional interruptions by eastern storms."[33]

1801, A. Mackenzie, Voyage from Montreal, on the River St. Laurence, through the Continent of North America, to the Frozen and Pacific Oceans, In the Years 1789 and 1793, pp. 127, 128, 132, 379, 404-406; 1802, J. Drayton, View of South-Carolina, pp. 16-27; 1804, R. Munro, Description of the Genesee Country, pp. 10, 11; 1804, Mémoires sur la Louisiane et la Nouvelle-Orléans, pp. 3, 4; 1807, C. C. Robin, Voyages dans l' Intérieur de Louisiane, iii, 269-274; 1807, G. Heriot, Travels through the Canadas, pp. 30, 261-266; 1807, J. Mease, Geological Account of the United States, pp. 61-118; 1809, H. Gray, Letters from Canada, pp. 243-256, 282-321; 1809, Essay on the Climate of the United States, Philadelaphia; 1809, D. Ramsay, History of South-Carolina, ii, 49-69; 1810, J. Lambert, Travels through Lower Canada and the United States of North America, i, 110-132, ii, 350, 351, 463-480; 1810, F. Cuming, Sketches of a Tour to the Western Country, pp, 321, 380, 394, 395; 1811, H. Williamson, Observations of the Climate in different Parts of America, pp. 1-30; 1812, H. Williamson, History of North Carolina, ii, 173-211; 1812, J. Melish, Travels in the United States of America, i, 76,77, 98, 102, 114, 124, 135, 145, 172, 173, 179, 188, 189, 207, 235, 260, 280, 281, 290, ii, 42, 190, 192, 203, 237, 278; 1813, D. W. Smyth, Short Topographical Description of His Majesty's Province of Upper Canada in North America; 1813, R. Dickinson, Geographical and Statistical View of Massachusetts Proper, pp, 13-23; 1814, H. M. Brackenridge, Views of Louisiana, pp. 31, 32, 111, 112; 1815, J. Bouchette, Topograpical Description of the Province of Lower Canada, pp. 57-61, 595; 1816, J. Whipple, History of Acadie, Penobscot Bay and River, pp. 5-8; 1816, M. Greenleaf, Statistical View of the District of Maine, pp. 19-29; 1817, W. Darby, Geographical Description of the State of Louisiana, the Southern Part of the State of Mississippi, and Territory of Alabama, pp. 43, 44, 243-280; 1817, J. Sansom, Sketches of Lower Canada, pp. 129-133; 1818, W. Tudor, Letters on the Eastern States, pp. 258-266; 1818, W. Darby, Emigrant's Guide to the Western and Southwestern States and Territories, pp. 230-250; 1819, C. B. Johnson, Letters from the British Settlement in Pennsylvania, pp. 98-101; 1819, D. Thomas, Travels through the Western Country in the Summer of 1816, pp. 56-59, 197-203; 1819, E. Mackenzie, Historical, Topographical, and Descriptive View of the United States, pp. 39, 40, 536-549; 1819, J. C. Pease and J. M. Niles, Gazetteer of the States of Connecticut and Rhode Island, pp. 7, 8, 308; 1820, C. Stuart, Emigrant's Guide to Upper Canada, pp. 29-33; Memoirs of the American Academy of Arts and Sciences, iii, 107-121, 361-412, iv, 361-392; Medical Repository, Second Hexade, iii, 349-365, v, 363-374, vi, 23-45; Monthly Anthology, ix, 25-31; General Repository, iv, 313-356. It is useless to continue these references after 1820, as by that time the term Indian summer had become well established.

[28] Military Journal, 1859, p. 198. The Journal was also printed, together with another work, in 1860, and the passage will be found at page 402 of that edition. Major Denny was born in 1761, at Carlisle, Pa., and appears to have spent most of his life in that State. In March, 1794, he was sent by Governor Mifflin to establish a post at Presqu' Isle, Lake Erie. On the day when he made the above entry in his journal he was at Le Bœuf, on French Creek, about ten or twelve miles in a southerly direction from Presqu' Isle. The latter name is not uncommon in the region of the Great Lakes, but the place so called by Denny is now the city of Erie, though the old name is preserved in Presque Isle Bay.

[29] In Medical Repository, ii, 282. About the same time William Priest, an Englishman, made a remark worth noting. Writing from New York September 18, 1797, he said: "My Jersey intelligence was too true; but the disorder [yellow fever] is chiefly confined to one part of the city, and is effectually prevented from spreading at present by the northwest wind, which is set in this morning with uncommon severity; a circumstance which sometimes happens at this season of the year, and is of long continuance. This kind of weather the Indians call *half* winter. Unfortunately for the Philadelphians, they had no half winter in the year 1793." (Travels in the United States of America, 1802, pp. 150, 151).

With this compare the extract from Dr. Rush, already quoted under date of 1789.

[30] Tableau du Climat et du Sol des États-Unis d'Amérique, i, 292, 293. Volney's book was twice translated into English; by an Englishman, at London, in 1804, and by C. B. Brown, at Philadelphia, in 1804. It would be interesting to know exactly where Volney found the term in this country. He visited almost all sections, but does not say where, when, or how often he heard it. It has been urged that Volney's employment of the expression implies a wide use in this country. On the other hand, it seems to the present writer that the only safe conclusion to be drawn from Volney's remarks is that he heard the term somewhere in this country, but not necessarily in every part through which he traveled. The point I wish to make may be illustrated by an extract from the Journal of Jacob Fowler, edited by the late Dr. Elliott Coues in 1898. Under date of December 17, 1821, Fowler writes: "The Weather verry much moderated Haveing much the appeerence of the Indean Sommer." (Page 65.)

Fowler was then on the Arkansas River, in what is now the State of Colorado. Can we therefore conclude that Fowler heard the term used in that region? Most certainly we can not, for the obvious reason that at that time there were no English inhabitants in that region at all. In short, Fowler, who was born in New York and who had, previous to the time of his Journal, lived in Kentucky, took the term to the West with him.

It has also been urged, in conversation with the writer, that the infrequency with which the expression is met with before 1800 indicates not so much its rarity as the fact that it was so common as not to excite comment. But surely we can not assume the existence of a word merely because no one employs it. Besides, after 1820, by which time the term Indian summer had certainly become common, its commonness did not prevent people from using it or commenting upon it. Recognizing to the full that negative evidence must be received with caution, yet, in view of the complete silence of native historians before 1800 and of the complete silence of all writers, native or foreign, before 1794, I see no escape from the conclusion that the burden of proof lies on those who maintain that Indian summer was a term common before 1800 or known at all before 1794.

[31] Travels in America, Performed in 1806 (1808), ii, 153. My attention was called to this passage by Mr. E. P. Merritt of Boston.

[32] Observations on the Weather and Diseases in the Autumn of 1808, in the City of New York, in Medical Repository, Second Hexade, vi, 187.

[33] Gazetteer of the State of New York, p. 14. In the Oxford Dictionary, Dr. Murray gives no earlier example of "elegant" in its vulgar use

In 1815 Dr. D. Drake remarked:

"INDIAN SUMMER.

"In the autumn of every year, we have a period to which this appellation is affixed. It generally succeeds to rain or snow and severe frost; beginning in October or November, and continuing for two or three weeks, with an occasional storm. But the atmosphere is, for the most part, dry, serene, and smoky, through which the sun and moon exhibit in the morning and evening a face of darkened crimson. The verdure of the forest fades away, or passes into the countless varieties of brown, red, and yellow, which give to the surrounding scenery a dull and sombre aspect. The occurrence of rain, with a north-west wind at length suddenly dispels the gloom, strips the wood of its remaining foliage, and introduces winter, with a transparent and cheering atmosphere. The effect of this peculiar atmosphere on hypocondriacs, tho' less in degree, is similar to that produced by the November fogs of Great Britain." [34]

It sounds grotesque at the present day to find the Indian-summer season associated with gloom, and to hear that it has an unhappy effect upon hypochondriacs.

In 1817 John Bradbury, an English traveler, speaking of the Missouri Territory and of the Ohio River, observed: "About the beginning or middle of October the Indian summer [35] commences, and is immediately known by the change which takes place in the atmosphere, as it now becomes hazy, or what they term smoky. This gives to the sun a red appearance and takes away the glare of light, so that all the day, except a few hours about noon, he may be looked at with the naked eye without pain: the air is perfectly quiescent and all is stillness, as if nature, after her exertions during the summer, were now at rest. The winters are sharp, but it may be remarked that less snow falls, and they are much more moderate on the west than on the east side of the Alleghanies in similar latitudes. * * *

"The seasons and general state of the weather correspond with what has been mentioned of upper Louisiana in similar latitudes: In spring heavy rains; in summer an almost cloudless sky, with heavy dews at night; in autumn some rain, followed by the *Indian summer;* and the winter from ten weeks to three months long, which is dry, sharp, and pleasant." [36]

Writing from Shawnee Town, Illinois Territory, in December, 1817, H. B. Fearon, another English traveler, said: "With regard to the seasons, they are said to have severe winters of from three to four months, with a keen, dry air and cloudless sky; during summer, excessive heat (thermometer in the shade 80° to 96°), with heavy dews at night; springs, cold and heavy rains; autumns, fine, followed by '*Indian summer,*' which is truly delightful. This I have experienced, and can say that until now I never knew what really fine weather was." [37]

In 1819 Dr. H. M'Murtrie remarked: "A sketch of the weather during the last winter will convey as much information upon the subject, as a volume. Early in the fall the Indian Summer as it is called, succeeded the Autumn, and lasted four weeks with occasional days of extremely cold weather: this was succeeded by a week of changes the most sudden and extraordinary I ever witnessed, the ponds in the town, being frozen and thawed alternately during the same day, which was closed by a night equally as variable. The cold now appeared as though it had commenced in good earnest; during the space of three weeks it was very intense, quantities of drifting ice were seen on the Ohio, the ponds were incrusted by it three inches deep, when the wind, which had hitherto blown from the northwest, suddenly veering to the south and south-southwest, a warm rain fell, which dissolved the icy fetters of winter and again restored the Indian Summer. Such was the mildness of the weather till the latter end of January, that the buds of the peach trees were swelled, and had not a few frosty nights supervened, they must have blossomed." [38]

This is certainly one of the most singular passages we shall have to consider. For three centuries and a half most people have been content to regard autumn and fall as synonymous terms, but Dr. M'Murtrie seems to have entertained a different notion. According to him, the fall comes after the autumn. The Indian summer, in 1818, after lasting four weeks, was succeeded by one week of sudden changes, and this by three weeks of cold, when the Indian summer was again restored, and, perhaps, extended into January. But this is not certain, for the passage is very indefinite, though it at least shows that the Indian summer was regarded by M'Murtrie as lasting a long time.

In 1821 John Howison wrote: "The autumns of Upper Canada very much resemble those of Britain. October is usually a delightful dry month, with mild days and clear frosty nights. The early part of November is generally characterized by a peculiar state of the weather, which the Canadians term *Indian summer.* The atmosphere has a haziness and smokiness which makes distant objects appear indistinct and undefined, and a halo often encircles the sun. At the same time, a genial warmth prevails, and there is seldom any wind. The Indian summer is so delightful, that one would almost suppose the country where it takes place to be transported for a season to some celestial clime, where the elements ever existed in harmony and acted in unison. It is extremely difficult to explan the cause of the regular occurrence of this kind of weather; for scarcely a year passes, in the autumn of which there are not some days of Indian summer." [39]

In 1821 William Tudor remarked: "One of the most agreeable peculiarities in our climate is a period in the autumn, called the *Indian Summer;* it happens in October, commencing a few days earlier or later, as the season may be. The temperature is delightful and the weather differing in its character from that of any other season. The air is filled with a slight haze, like smoke, which some persons suppose it to be; the wind is south west, and there is a vernal softness in the atmosphere; yet the different altitude of the sun from what it has in the summer, makes it in other respects very unlike that season. This singular occurrence in our climate seems to be to summer, what a vivid recollection of past joys is to the reality." [40]

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than 1848. For more than a century, however, this use has been common in our country, and in 1817 M. Birkbeck, an English traveler, thus amusingly commented upon it:

"The grand in scenery I have been shocked to hear, by American lips, called disgusting, because the surface would be too rude for the plough; and the epithet of *elegant* is used on every occasion of commendation but that to which it is appropriate in the English language.

"*An elegant improvement* is a cabin of rude logs, and a few acres with trees cut down to the height of three feet, and surrounded by a worm-fence, or zig-zag railing. You hear of an *elegant* mill, an *elegant* orchard, an *elegant* tan-yard, &c., and familiarly of *elegant* roads, —meaning such as you may pass without extreme peril. The word implies eligibility or usefulness in America, but has nothing to do with taste." (Notes on a Journey in America, second edition, 1818, p. 133.)

[34] Natural and Statistical View, or Picture of Cincinnati and the Miami Country, p. 110.

[35] "Indians begin to provide for the winter when this state of the weather commences, as they know it will soon approach."

[36] Travels in the Interior of America, in the Years 1809, 1810, and 1811, pp. 258, 259, 282.

[37] Sketches of America, 1818, p. 221.

[38] Sketches of Louisville And its Environs, pp. 49, 50.

[39] Sketches of Upper Canada, pp. 230, 231. This is the earliest appearance of the term in Canada known to me.

[40] Letters on the Eastern States, second edition, p. 312. Tudor goes on to say that "the Indians have some pleasing superstitions respecting it," and then quotes from the Rev. J. Freeman a passage which will be considered later. It is curious that in the first edition of his Letters on the Eastern States, published in 1818, Tudor, though he devotes pp. 258-266 to climate, has not a word to say about Indian summer, and the passage quoted in the text appeared for the first time in the second edition.

In 1823 J. Farmer and J. B. Moore wrote: "From the 20th of September to the 20th of October, the weather is delightful. The temperature is mild, the air is sweet, and the sky singularly bright and beautiful. This period is denominated the Indian Summer." [41]

In 1826 Timothy Flint observed: "Then, when we were made fast in a cove on the wide sand-bar; when the moon, with her circumference broadend and reddened by the haze and smoke of Indian summer, rose, and diffused, as Chateaubriand so beautifully says, the 'great secret of melancholy over these ancient forests;'—after our evening prayers, and the favorite hymn, 'The day is past and gone,' etc. I have spent hours in traversing the sand-bars entirely alone." [42]

In 1829 James Macauley said: "In autumn there are usually several great movements in the atmosphere, which serve as so many precursors of the approach of winter. The first happens about the time of the equinox, and is often attended with heavy wind and more or less rain. * * * This is succeeded by fine weather, which lasts with some interruptions, till about the 10th or 20th of October, when the second occurs. This, like the preceding, is accompanied by wind and rain. There is, however, considerable difference. The winds are often very violent, and come near to hurricanes, * * * These winds rarely last over two or three days. They are followed by cold of some days duration, when the weather settles down and becomes fine. The Indian Summer, a series of smoky days, usually follows or comes shortly after the settlement. Its continuance is now and then two weeks. The Indian Summer, at present, is shorter, and comes later than formerly. A third begins about the middle or latter part of November." [43]

In the same year John MacTaggart remarked: "The snow generally begins to fall about the middle of November: in the woods, it is seldom attended with wind, but in the cleared places it blows into huge wreaths; the roadways are filled full between the fences. In the beginning of the above-named month, there are generally a few very fine warm days, called the *Indian Summer*." [44]

By 1830 the term had found its way to England, for in that year De Quincey, alluding to Bentley, wrote: "An Indian summer crept stealthily over his closing days; a summer less gaudy than the mighty summer of the solstice, but sweet, golden, silent; happy, though sad; and to Bentley, upon whom (now eighty years old) his last fatal illness rushed as suddenly as it moved rapidly through all its stages, it was never known that this sweet mimickry of summer—a spiritual or fairy echo of a mighty music that has departed—is as frail and transitory as it is solemn, quiet, and lovely." [45]

In 1832 John M'Gregor said: "In September, the weather is extremely pleasant. The season, from this time to the middle or latter part of October, is generally a continuation of pleasant days. * * * About the end of this month, * * * there appears in the atmosphere a determination to establish cold weather. * * * Rain, sunshine, evaporation, and slight frosts, succeed each other, and the leaves of the forest from this period, change their verdure into the most brilliant and rich colours. * * * After this crisis, the air becomes colder, but the sky continues clear; and a number of fine days usually appear in November. There are frosts at night, but the sun is warm in the middle of the day; the evenings and mornings are pleasant, but cool, and a fire becomes agreeable. This period is termed all over America the 'Indian summer,' and is always looked for, and depended on, as the time to make preparations for the winter season." [46]

In 1833 a Baltimorean wrote: "The term Indian summer, has been applied to that obscure and hazy condition of the atmosphere, which usually occurs toward the last of November, attended with a peculiar redness of the sky, an absence of rain, and we might add an obviously increased temperature; which latter fact is in some degree significant of its name. * * * Having stated that the Indian summer appears usually in the month of November, we do not however, wish to be understood, that a haziness or obscurity of the air occurs in that month only, and that its duration is confined, and peculiar to, a few days in the latter part of the autumnal season—on the contrary, common observation (as well as the minute references to meteorological tables) proves, that it is by no means uncommon in the month of October, and is frequently mistaken then for the true Indian summer, by persons unacquainted with the proper period of its accession. * * * It is worthy of remark, that according to the recollection of our older inhabitants, its former duration was often three or four weeks, whereas its present continuance is short and uncertain, seldom exceeding ten or fifteen days. It appears further, that this decline has been somewhat regular, keeping pace with, and evidently influenced by, the gradual uncovering of the country." [47]

In 1835 C. J. Latrobe, an English traveler, remarked: "I have mentioned, that uncertain as the occurrences of genial weather might now be in this latitude, we had been encouraged to hope that the delicious season, known by the name of the Indian Summer, which ordinarily intervenes between the fall of the leaf and the commencement of the severe winter of the north, might yet come to our aid in the prosecution of our excursion. It is true, the north wind blew while we were at Prairie de Chien, * * * still we were not deceived, but before the lapse of many days we saw the sleet disappear—the wind cease to agitate the river and the forest—the wild fowl pause in their passage, and, furling their pinions, alight by myriads among the islands and marshes, and, as though by enchantment, a season settle down upon the earth, which, for its peculiar beauties, might vie with the most poetical and delicious in the circle of the year. To what shall we compare the Indian Summer? To the last bright and unexpected flare of a dying taper—to the sudden and short-lived return to consciousness and apparent hope in one stretched upon the bed of death, after the standers by have deemed him gone—or to the warm, transient, but rosy glow which will often steal over the snows of the distant Alps, after

[41] Gazetteer of the State of New Hampshire, p. 9.

[42] Recollections of the Last Ten Years, Passed in the Valley of the Missisipi, p. 285.

[43] Natural, Statistical, and Civil History of the State of New York, i, 369, 370.

[44] Three years in Canada: An Account of the Actual State of the Country in 1826–1828, ii, 2.

[45] Bentley, Works, 1843, vi, 180. The beginning of the passage is cited in the Oxford Dictionary. De Quincey adds a note which is of interest as showing how readily the term found acceptance in England: "The Indian summer of Canada, and I believe universally of the Northern United States, is in November, at which season, in *some* climates, a brief echo of summer uniformly occurs. It is a mistake to suppose it unknown in Europe. Throughout Germany (I believe also Russia) it is popularly known, sometimes as *The Old Woman's Summer*, sometimes as *The Girl's Summer*. A natural question arises—what lurking suggestion it is of dim ideas or evanescent images that confers upon the Indian summer its peculiar interest. Already in its German and Livonian names we may read an indication, that by its primary feature this anomalous season came forward as a *feminine* reflection of a power in itself by fervour and creative energy essentially *masculine;* a *lunar* image of an agency that, by its rapture and headlong life, was imperishably *solar*. Secondly, it was regarded as a dependency, as a season that looked back to something that had departed, a faint memorial (like the light of setting suns) recalling an archetype of splendours that were hurrying to oblivion. Thirdly, it was itself attached by its place in the succession of annual phenomena to the *departing* year. By a triple title, therefore, the Indian summer was beautiful, and was sad. For august grandeur, self-sustained, it substituted a frailty of loveliness; and for the riot and torrent rapture of joy in the fullness of possession, exchanged the moonlight hauntings of a visionary and saddened remembrance. In short, what the American Indian race itself at this time is, *that* the Indian summer represents symbollically—viz., the most perfect amongst human revelations of grace in form and movement, but under a *visible* fatality of decay."

[46] British America, i, 125–127. My attention was called to this passage by Miss Sara Mickle of Toronto.

[47] American Journal of Science, 1835, xxvii, pp. 140, 141, 146.

the sun is far below the Jura, and after they have been seen rearing themselves for a while, cold and ghastly white, over the horizon?

"During the Indian Summer the air is calm. Glistening strings of gossamer, woven by the æronaut spider, stream across the landscape—all nearer objects are seen through a dreamy atmosphere filled with a rich golden haze, while the distance melts away in violet and purple. The surface of the river, with its moving flood of silver reflects all objects and every colour with matchless fidelity—the harsher tones of the rocks, of the deep brown forests, and of the yellow prairies appear so softened,—the reflection of their pale tints is so perfect, and such a similarity of colour and shade pervades the earth, the air and the water, that all three seem blended together." [48]

In 1837 Longfellow, speaking of Sweden, observed: "Nor must we forget the sudden changing seasons of the Northern clime. There is no long and lingering spring, unfolding leaf and blossom one by one; no long and lingering autumn, pompous with many-colored leaves and the glow of Indian summer. But winter and summer are wonderful, and pass into each other." [49]

In 1838 some unknown person wrote:

"To a resident in New England the very name of Indian Summer calls up so many essentially poetic images, that it is difficult to approach the subject without permitting the thoughts to run riot over the fairy scenes which that season presents; and we marvel not that it has suggested to the muse of America some of her most brilliant effusions: for it would require no great effort of the imagination to perceive in its balmy and buoyant air a portion of that *divinus afflatus* of which the old poets spake. * * * In the early part of October a strange interruption occurs to the progressive fall of the mercury, and when in the natural course of events we should be led to anticipate a still further increase of cold, we are surprised to perceive, that for two or three weeks successively, with a few slight exceptions, an elevation of temperature is experienced, to a greater degree in many cases than the average of the first week of September,—sometimes as great as the mean of the month of August. * * * But with us the 'afterheat' is attended with circumstances of no uncommon interest and beauty. In New England especially it is a rich and glorious season, in which Nature would seem struggling to withdraw attention from the decay which is stealing upon her, by the increased gorgeousness of her apparel, and the spring-like youthfulness of her voice and air; hiding moreover those defects which she can not otherwise conceal, by a thin veil of mild and smoky haze.

"The most peculiar characteristic of this Second Summer consists in the wonderful and beautiful change which takes place in the forest. This feature, however, though it continues throughout the whole of the Indian Summer's brief reign, begins, strictly speaking, to develope itself at an earlier period. * * *

"Scarcely has nature become enveloped in this gorgeous winding sheet, when the other characteristics of the Indian Summer begin to develope themselves. The temperature of the atmosphere during the hours of sunshine becomes milder than it has been for weeks before. There is a balmy and voluptuous softness and stillness in the air, resembling the early days of June. There is not wind enough to shake from the trees the leaves which hang from their branches by so feeble a tenure. A thin, smoky haze floats over the whole face of nature, softening and blending distant objects, and, combined with the tints of the neighbouring forests, giving a warmth of tone and coloring to the whole landscape. * * * The sun, though pale in the meridian height, at his setting is tinged with a ruby gleam, which is reflected from the windows, and which suffuses every object on which it is thrown. The moon also wears a blush as she rises, and the planets which hang in the flushing west wear a more golden aspect than is their wont." [50]

[48] The Rambler in America, ii, pp. 196–198.

[49] Drift-Wood, Prose Works, 1886, i, 324.

In 1839 Bela Hubbard said: "October 20. * * * Since 13th instant we have been favored with balmy Indian summer. All nature is hushed and wrapped in a thin, misty robe. Through this the sun's rays fall, robbed of their earlier brilliance and fervor and of a deeper and milder red.

"October 27. This delicious weather has continued until to-day, when a shower set in." [51]

On September 8, 1841, Thoreau wrote: "Your note came wafted to my hand like the first leaf of the Fall on the September wind, and I put only another interpretation upon its lines than upon the veins of those which are soon to be strewed around me. It is nothing but Indian Summer here at present. I mean that any weather seems reserved expressly for our late purposes whenever we happen to be fulfilling them." [52]

In 1841 Whittier wrote:

"Thus, while at times before our eyes
The shadows melt and fall apart,
And, smiling through them, round us lies
The warm light of our morning skies,—
The Indian Summer of the heart!
In secret sympathy of mind,
In founts of feeling which retain
Their pure, fresh flow, we yet may find
Our early dreams not wholly vain!" [53]

In 1842 Zadock Thompson said: "But it appears that from the commencement of the settlement of the country, the Indian Summers have gradually become more and more irregular and less strikingly marked in their character, until they have almost ceased to be noticed." [54]

In the same year J. F. Watson observed:

"INDIAN SUMMER.

"This was a short season of very fine, mild weather, which was formerly much more manifest than of later years. It was expected to occur in the last days of November. It was a bland and genial time, in which the birds, the insects, and the plants, felt a new creation, and sported a short-lived summer, ere they shrunk finally from the rigour of the winter's blast. The sky, in the mean time, was always thinly veiled in a murky haze—intercepting the direct rays of the sun, yet passing enough of light and heat to prevent sensations of gloom or chill. * * *

"The known amenity of such a season was fixed upon, in olden time, as the fittest time for the great fair at Philadelphia, which opened on the last Monday in November, and continued three days, thus insuring, as they conceived, as many good days, before and after the term, for good traveling to and from the same. The fair in the last week of May was also chosen for its known settled weather." [55]

[50] United States Magazine and Democratic Review, iii, 153–159.

[51] Memorials of a Half Century, 1887, p. 570.

[52] Familiar Letters, 1894, p. 43.

[53] Memories, Poetical Works, 1888, ii, 97, 98.

[54] History of Vermont, i, 16.

[55] Annals of Philadelphia and Pennsylvania, ii, pp. 362, 363. In the National Intelligencer of Thursday, November 26, 1857, No. 8579, p. 2, appeared a communication signed "H.," from which the following is taken:

"The short season of pleasant weather usually occurring about the middle of November is called the Indian summer, from the custom of the Indians to avail themselves of this delightful time for harvesting their corn, and the tradition is that they were accustomed to say that 'they always had a second summer of nine days just before the winter set in.' It is a bland and genial time, in which the birds, insects, and plants feel a new creation, and sport a short-lived summer ere they shrink finally from the rigor of the winter's blast. The sky in the mean time is generally filled with a haze of orange and gold intercepting the direct rays

In 1842 Hawthorne remarked: "October 10th. * * * In the meantime autumn has been advancing, and is said to be a month earlier than usual. We had frosts sufficient to kill the bean and squash vines, more than a fortnight ago; but there has since been some of the most delicious Indian-summer weather that I ever experienced,—mild, sweet, perfect days, in which the warm sunshine seemed to embrace the earth and all earth's children with love and tenderness. * * * November 8th. * * * Ever since our return [from a trip of nine days], however, until to-day, there has been a succession of genuine Indian-summer days, with gentle winds, or none at all, and a misty atmosphere, which idealizes all nature, and a mild, beneficent sunshine, inviting one to lie down in a nook and forget all earthly care. To-day the sky is dark and lowering, and occasionally lets fall a few sullen tears. I suppose we must bid farewell to Indian summer now, and expect no more tenderness from Mother Nature till next spring be well advanced."[56]

In 1844 the Rev. C. Dewey, speaking of the seasons of the previous year, said: "The fine warm smoky days, which commonly take place in October, or the beginning of November, and called Indian summer, did not appear this year in their usual perfection. Indeed, it was a common remark, that we had no Indian summer. * * * On the 17th of November the atmosphere was quite smoky, and a slight Indian summer appeared for eight days in succession."[57]

In 1846 W. E. Maxwell remarked: "On reading, in Mr. Birt's report on 'Atmospheric Waves,' presented at the meeting of the British Association [see Athenæum of September 26], the account of the great November wave, it has struck me as a curious coincidence that the period of the maximum of the wave—viz, from the 12th to the 17th of November—is precisely that given by American travelers for the occurrence of that most remarkable meteorological phenomenon, *the Indian summer;* when, after having already had a foretaste of the rigours of the approaching winter, a sudden change of temperature takes place, a delicious warmth is felt, the sky is without a cloud, not a breath of air is stirring, and the whole atmosphere is filled with a glowing transparent haze,—which state of weather lasts about three days."[58]

In 1847 Charles Peirce published a volume giving an account of the weather at Philadelphia from 1790 to 1846. Perhaps the most singular feature of this book is that it does not contain a single allusion to smoke, but a single allusion to haze, and only three allusions to the Indian summer during those forty-seven years.[59]

of the sun, yet passing enough light and heat to prevent sensations of gloom or chill, while the nights grow sharp and frosty, and the necessary fires give cheerful forecast of the social winter evenings near at hand."

"H." concludes by an allusion to St. Martin's summer and by quoting Shakespeare. It is clear that "H." coolly appropriated the passage cited in the text from Watson and passed it off as original.

[56] American Note-Books, 1883, pp. 326-328. Hawthorne was at Concord, Mass. In a novel written in 1851, Hawthorne said: "Indeed, all the enjoyments of this period were provocative of tears. Coming as late as it did, it was a kind of Indian summer, with a mist in its balmiest sunshine, and decay and death in its gaudiest delight." (House of the Seven Gables, 1883, p. 180.)

[57] In the Fifty-Seventh Annual Report of the Regents of the University of the State of New York, 1844, p. 231. Rochester, N. Y., is referred to. On October 31, 1854, Mr. Dewey wrote: "Primary and secondary rainbows at west this morning and evening large and fine. Indian summer for nine preceding days." (Sixty-Eighth Annual Report, 1855, p. 298.) My attention was called to these Reports by Professor Abbe.

[58] The Athenæum, October 17, 1846, p. 1070. In the Athenæum of November 14 a correspondent, writing from Ostend, said: "In Switzerland the same phenomenon has been remarked from time immemorial, and l'Été de St. Martin has passed into a proverb. Now, the 11th of November is the fête of this worthy;—and from diaries which I kept during six consecutive years in Switzerland and southern Bavaria, I find that, with the exception of 1837, we had a return of perfect summer weather for four or five days together,—and this, after the season had apparently completely broken up. In all cases, this occurred about that same period—or rather toward the 14th of the month." (P. 1171.)

On September 29, 1848, Lord Houghton wrote: "We have just had one of those autumnal summers (one of those Indian summers that old Gentz said Fanny Ellsler gave him) which turn the English year topsy-turvey. It is now over, and we are back to the old climate again."[60]

In 1848 S. P. Hildreth observed: "In October, and fore part of November, the weather is usually serene and delightful, rivaling in the mellow and balmy state of the atmosphere, that of Greece, or Italy. It is in fact the most poetic season of the year. The various hues imparted to the forests by the advance of autumn, which daily changes and deepens their rich and gorgeous tints, when seen through the light mists of our 'Indian summer,' gives a charming and romantic view to the landscape, which few portions of the world can equal and none surpass."[61].

In 1849 Charlotte Brontë observed: "It was a peaceful autumn day. The gilding of the Indian summer mellowed the pastures far and wide. The russet woods stood ripe to be stript, but were yet full of leaf. The purple of heath-bloom, faded but not withered, tinged the hills.[62]

On October 31, 1850, Thoreau said: "This has been the most perfect afternoon of the year. The air quite warm enough, perfectly still and dry and clear, and not a cloud in the sky. Scarcely the song of a cricket is heard to disturb the stillness. Our Indian summer, I am tempted to say, is the finest season of the year. Here has been such a day as I think Italy never sees."[63]

[59] Meteorological Account of the Weather in Philadelphia from January 1, 1790, to January 1, 1847. The allusions to Indian summer are as follows, the references being to November, 1831, 1840, and 1844, respectively: "It commenced and continued mild and pleasant (Indian-summer like) until the 11th, with the wind varying from west to south. * * * The medium temperature of this month was 43°, and it commenced with what is generally called '*Indian Summer*', and so continued until the 8th, when the wind changed to northeast, and rain soon followed. * * * There were eighteen clear days, and a great part of the month was like Indian summer in this vicinity." (Pp. 225, 231, 234.)

In his preface Peirce says that he has "kept a regular account of the weather for a longer period of time, than, perhaps, any other person now living." In this connection mention may be made of the Journal of the Rev. Thomas Smith (edited by W. Willis in 1849), which, extending from 1722 to 1787, is filled with details about weather. There are constant references to mild, warm, and pleasant days in September, October, November, and December, and also to cold, stormy, and unpleasant days during the same months; but there is not so much as a single allusion to smoke or haze during those four months in the sixty-six years covered by the journal.

[60] Life, Letters & Friendships, 1891, i, 407. Writing from Washington November 14, 1875, and again from Dunfermline, Scotland, October 16, 1879, Lord Houghton said:

"This tour of mine has had its difficulties, and I have never been quite well for a single day. I am perhaps better now, the weather being delightful—the real Indian summer. * * * I and Florence are descending to England, having had our Indian summer in magnificent scenery." (ii, 327, 386.)

[61] Pioneer History: being an Account of the First Examinations of the Ohio Valley, and the Early Settlement of the Northwest Territory, p. 493.

[62] Shirley (Tauchnitz edition), ii, 200. Cited in E. C. Brewer's Dictionary of Phrase and Fable, 1895, p. 653.

[63] Autumn, 1894, p. 181. This volume contains numerous allusions to the Indian summer, and it will be of interest to observe the days on which Thoreau noted Indian-summer weather. They are: September 27th, October 7th, 13th, 14th, 31st, November 1st, 7th, 8th, 17th, 23d, 25th, December 7th, 10th, and 13th. Thus, at a single locality (Concord, Mass.), in a single volume, within a period of ten years (1851 to 1860) a single writer's allusions to Indian summer run all the way from September 27th to December 13th, or seventy-seven days. Nothing could better show the elasticity and the utter indefiniteness of the term in the popular mind. With Thoreau's observations may be compared some made by a scientific investigator. Professor Hind prints in his Narrative of the Canadian Red River Exploring Expedition, 1860, ii, 384, a table furnished by Mr. James Walker, Assistant at the Provincial Observatory at Toronto. The observations cover a period of twenty years (1840 to 1859). According to Mr. Walker the Indian-summer season begins between October 5th and November 20th, and ends between October 11th and November 23d, its shortest duration is three days, its longest eleven days, and its mean duration six days. The season twice made its appearance in the years 1844 and 1857.

The reader's attention may also be called to another curious passage.

In 1850 Susan Fenimore Cooper wrote: "One is led to believe that the American autumn has helped to set the fashion for the sister season of the Old World; that the attention which the season commands in this country, has opened the eyes of Europeans to any similar graces of the same months in their own climates; the gloom is less heeded by them, while every pleasing touch is noted with gratification. In the same way, we now see frequent allusions to the 'Indian summer' by Englishmen, in their own island, where this last sweet smile of the declining year was entirely unheeded until its very marked character in this country had attracted admiration. Our native writers, as soon as we had writers of our own, pointed out very early both the sweetness of the Indian summer, and the magnificence of the autumnal changes. In fact, they must have been dull and blind not to have marked both these features of the season, as we usually enjoy them. And here, indeed, we find the precise extent of the difference between the relative beauty of autumn in Europe and in America: with us it is quite impossible to overlook these peculiar charms of the autumnal months; while in Europe, though not wholly wanting, they remained unnoticed, unobserved, for ages. Had the same soft atmosphere of the 'Indian summer' warmed the woods of Windsor, year after year, while Geoffrey Chaucer roamed among their glades, the English would have had a word or a phrase to express the charm of such days, before they borrowed one from another continent." [64]

This passage invites comment. It is true that "our native writers, as soon as we had writers of our own, pointed out" the delights of the Indian summer and the beauties of our autumn foliage; but we had no such writers, in the sense meant by Miss Cooper, until late in the eighteenth century, and for almost two hundred years Americans had been both "dull and blind" to those features of the autumn. Miss Cooper, too, is mistaken in thinking that the English had "no word or phrase to express the charm of such days;" they had and have several such phrases. The term All-hallown summer [65] occurs in Shakespeare, as also does St. Martin's summer; [66] the term Go-summer [67] was formerly current in Scotland; at the present day one finds in England St. Martin's summer and St. Luke's summer; and an expression apparently meaning St. Michael's summer is said to be used in Wales. [68] It will be convenient to mention in this place some expressions found elsewhere in Europe. In France the summer of St. Denis and St. Martin's summer are employed both literally and figuratively; [69] in Germany, Altweibersommer [70] is current; and in several countries other expressions are said to be found. [71] Thus, as the late R. G. White remarked, "even this beautiful season is therefore not one of those good things which are peculiarly 'American.'" [72]

In a letter dated "General Land Office, November 22, 1819," a person who signed himself "J. M." wrote: "*Indian summer.*—This interesting *meteor* has had a *name* ever since the earliest settlements of our country. * * * *Peyton S. Symmes*, Esq., Register of the Land Office at Cincinnati, has communicated more exact notices of this *meteor* than any other of my correspondents. I present his notices, observing that Indian summer is always in the *autumnal* season—the *falling of the leaf:*

"'1818. Indian summer begins September 23, suspended October 3; returns October 7, suspended October 20; returns October 22, suspended November 6; returns November 8, suspended December 6; returns December 7, suspended December 28; returns December 29. 1819. Indian summer begins October 1, suspended October 9; returns October 23, *continues* October 31.'

"From this it appears that, of the ninety-seven days between September 23 and December 29, 1818, *eighty-eight* had the character of *Indian summer.*" (Columbian Centinal, 1 December, 1819, No. 3719, p. 2.)

[64] Rural Hours, pp. 335, 336. This occurs under date of October 11. Under October 16 Miss Cooper wrote: "Charming weather; bright and warm, with hazy Indian summer atmosphere. They are harvesting the last maize-fields" (p. 344).

[65] In the First Part of Henry IV, i, ii, 178, Prince Hal, in taking leave of Falstaff, says: "Farewell, thou latter spring! farewell, All-hallown summer!"

After quoting the above in the Oxford Dictionary, Dr. Murray observes: "*All-hallown Summer:* a season of fine weather in the late autumn; also *fig.* brightness or beauty lingering or reappearing in old age. Apparently *Obs.*, but worthy of revival, as much superior to its equivalents, *St. Martin's Summer* (from French), and the *Indian Summer* of America."

There is no evidence to show that such an expression was ever employed either in Old France or in New France. Longfellow drew most of his material for that poem, so far as it relates to Nova Scotia, from T. C. Haliburton's Historical and Statistical Account of Nova Scotia, published in 1829; but Haliburton does not appear to say anything about the summer of All Saints. Longfellow's statement, then, is either due to poetic license or else is drawn from some unknown source. What Sir Adams G. Archibald said in 1886 is to the point: "We do not quarrel with Longfellow on the ground of historical inaccuracy. The poet is not required to confine himself to the region of facts. He constructs his story as he chooses, subject only to the rules of art. It is to truth in this respect, not to the truth of facts, that he owes allegiance." (Collections of the Nova Scotia Historical Society, v, 13.)

The term was still known in England early in the nineteenth century, for the Englishman who translated Volney's Tableau said that the St. Martin's summer of France was "in England, an All-hallown summer." (View of the Climate and Soil of the United States, p. 262 note.)

In 1847 Longfellow in his Evangeline wrote:

"Such was the advent of autumn. Then followed that beautiful season,
Called by the pious Acadian peasants the Summer of All-Saints!"

[66] In the First Part of Henry VI, i, ii, 131:

"This night the siege assuredly I'll raise:
Expect Saint Martin's summer, halcyon days,
Since I have entered into these wars."

[67] See the Oxford Dictionary under Gossamer and Go-summer, and compare the German Altweibersommer.

[68] See Notes and Queries, 1874, Fifth Series, ii, 381, 477, 518. In the same place there is an illusion to "All Saints' summer," as if the term were still known in England.

[69] In the seventeenth century Madame de Sévigné wrote: "Nous avons un petit été de Saint-Martin, froid et gaillard, que j'aime mieux que la pluie."

In the nineteenth century X. A. de Montépin wrote: "Que diable voulez-vouz? mon été de la Saint-Martin ne veut pas finir! Je n'y puis rien."

These extracts are taken from P. Larousse, Grand Dictionnaire Universel du XIX Siécle, vii, 1023. See also Littré.

[70] See Brockhaus' Konversations-Lexikon, 1892, i, 480, and Meyers Konversations-Lexikon, 1893, i, 452.

[71] In 1873 the Rev. C. Swainson, for the accuracy of whose statements, however, I do not vouch, said: "In Lombardy the peasants always expect a few fine days towards the middle of this month [October], which they call 'L'està de Santa Teresa,' *i. e.*, St. Teresa's summer, because the festival of that saint falls on the 15th; and the warm weather which we so often experience at this season, is in almost every European country known by the name of summer. Thus the Germans call it 'Altweiber Sommer,' or the summer of St. Gall (October 16), or 'of St. Martin' (November 11): the Swedes give it the title of St. Bridget's Summer (St. Bridget's day being October 8): the Bohemians, 'the Summer of St. Wenceslaus' (September 28): the Belgians, 'St. Michael's Summer:' our own country people 'St. Luke's little Summer;' and the French, 'L'été de Saint Denis' (October 9). The Americans call it, 'The Indian Summer.'" (Handbook of Weather Folk-Lore, p. 134.)

Finally, as we shall presently see, St. John's summer is reported to be employed in the Argentine Republic.

[72] The Galaxy, xxv, 94, 95. White also says that "there is nothing peculiar in the American Indian summer but the rich coloring of its foliage, and perhaps the warm golden haze which here then fills the air." White places the season "in the middle of November."

[To be concluded in February REVIEW.]

NOTES AND EXTRACTS.

YELLOW SNOW IN MICHIGAN.

The following is from the daily journal for Grand Haven, January 27, 1902:

From 3:40 to 5 p. m. occurred the unusual phenomenon of a fall of snow of a dull yellowish tint, which covered the ground to a depth of one-fifth of an inch. High but gradually diminishing westerly winds prevailed at the time. On melting the snow, a thin film (powder-like) covered the surface of the water and the sides of the vessel, but there was no sediment at the bottom of the vessel. It is reported that this yellow snowfall extended eastward of the station about twelve miles and northward about the same distance to Muskegon, but none was observed to the westward between the sand hills and the lake shore.

Prof. C. D. McLouth, of Muskegon, made a critical examination of samples collected at that place, and found that when isolated from the snow the coloring matter was a deep shade of yellow orange, and consisted of irregular powder-like opaque or translucent grains, from $\frac{1}{2000}$ to $\frac{1}{200}$ inch in diameter, that became semipasty when wet and would sink in water. The principal constituent was an infusible substance, probably silica; iron was plainly indicated, there was but little organic matter, the material changed color distinctly in hot flame, and the specimens collected at different places were quite similar. Professor McLouth confirms the statement of the observer at Grand Haven that the deposit of yellow snow was slight on the west slope of the sand dunes. It was observed on the trunks and branches of trees, and on the upper landing of the high school tower, 105 feet above the level of the lake. The sand dunes are from 100 to 200 feet high.

From a single determination the amount of coloring matter per square foot was found to be 1.855 grains, or about 5.59 tons per square mile.

From the Grand Haven Daily Tribune we learn that Dr. Lane, the State Geologist at Lansing, was sent a sample of the yellow snow.

He pronounced the substance *loess*, a fine clayey sand found in Wisconsin and Iowa. In all probability, says Dr. Lane, the sand was picked up by a windstorm as it traversed Wisconsin and after being carried across Lake Michigan was precipitated with a light fall of snow.

Colored snow has been previously discussed in the MONTHLY WEATHER REVIEW[1] and the conclusions of Dr. Lane agree with those there given. The high wind prevailing over Lake Michigan had no doubt brought with it fine sand from the plains to the west or southwest.

It has already been shown in the MONTHLY WEATHER REVIEW for September, 1901, p. 422, that a wind of this character is liable to cause a snowfall in winter on the windward shore of the lake, "because winds blowing toward it (the shore) from the water meet with great resistances and turn upward as they surmount the sluggish air near the ground." The moisture in the air might use the sand particles as a nuclei about which to condense and form snowflakes, and these falling flakes might bring other sand particles down with them. Hence the peculiar color of the snow.—*H. H. K.*

BARTHOLOMEW'S PHYSICAL ATLAS. METEOROLOGY.

The third volume of this atlas is devoted to meteorology and has been prepared by Bartholomew and Herbertson, and edited by Alexander Buchan. It presents all parts of the world with equal fairness. Its scope is as follows:

The four hundred maps in the atlas are comprised under two heads—Climate and Weather. The climate maps summarize the observational data and form a basis for the study of the climatology of the globe. These deal with the mapping of temperature, pressure, winds, cloud, sunshine, and rainfall, and show the distribution of these factors of climate, first for the world generally, and then on a larger scale for the separate countries where numerous observations supply more detailed material. The weather maps, together with the seasonal and storm charts, show meteorological conditions over certain regions at given periods, and represent all the most characteristic weather types.

The text, descriptive and explanatory of the maps, directs attention to their prominent features and touches upon the cause and effect of special phenomena. In the appendices the list of meteorological services with their stations and publications has been compiled from direct statistics supplied by their directors. A critical bibliography gives a list of the more important books and papers of special value for reference. A glossary of meteorological terms, comparative tables, and an index have also been added.

Throughout the atlas the metric system has been systematically employed in conjunction with the usual English scales, thus affording a ready means of comparison.

An American edition of this volume is announced by J. B. Lippincott Company, Philadelphia. The price is about the same as for the English edition, or $12.50 to public libraries that are entitled to import books duty free.—*H. H. K.*

[1] See Vol. XVII, p. 89, Vol. XXIII, pp. 15-19, and Vol. XXIX, p. 465.

THE HURRICANES OF THE FAR EAST.[1]

The author of this work has endeavored to so arrange our knowledge of the typhoons of the far East as to render it available for the use of sailors who navigate the seas in that part of the world. He acknowledges his indebtedness to the writings of Viñes, Eliot, and Doberck, and especially to those of Algué, whose Baguios ó ciclones Filipinos forms the basis of this book.

The general style, while somewhat disconnected, is on the whole very creditable, but the translation is not free from Germanisms and errors that at times obscure the meaning.

The book is divided into four sections. The first of these is devoted to a general discussion of tropical cyclones, particularly those of the far East. Horizontal and vertical sections of typhoons are shown in plates 1 and 2; these sections are divided into quadrants and zones, and the characteristics of each are represented graphically, and also described in the text.

Typhoons or baguios are divided into three groups; (1) those of the four winter months, December-March, (2) those of the intermediate months, April, May, October, and November, and (3) those of the summer months, June-September.

The place of origin is shown to change slightly for each group, being farther south and farther east in winter than in summer.

The author maintains that the primary cause of the origin of these storms is an area of barometric depression, but the rotation of the earth and the latent heat liberated by condensation of vapor are the forces that give it the tremendous energy that is developed later.

The chapter on the "Movement of the atmosphere in cyclones" is nearly all to be found in Viñes's "Investigation of the cyclone circulation and translatory movement of West Indian hurricanes," pp. 7-12. Washington, Weather Bureau, 1898.

The movement of the barometer during the passage of tropical cyclones is divided into three periods, corresponding to the three zones of the storm. In the first, or outer, zone the barometer falls slowly, and the distinct daily fluctuations are not effaced. In the second, or middle, zone there is a distinct fall which effaces the daily fluctuations, while in the third, or inner, zone the fall is very rapid. Tables have been pre-

[1] By Prof. Dr. Paul Bergholz. English translation revised by Dr. Robert H. Scott, F. R. S. 271 pp., 31 plates. Bremen, 1899.

pared showing the average pressure at the boundary lines between the different zones, and also the probable distance from the center of the cyclone corresponding to certain readings of the barometer.

The different types of rainfall, including thunderstorms, experienced in the different quadrants and zones, the part condensation plays in maintaining the energy of the cyclone, and the eye of the storm, are subjects receiving special attention. Tables have also been prepared showing the mean velocity of propagation for cyclones of each group, their direction of motion when crossing the meridian of Manila, and their nearest aproach to Manila.

Section II treats of the "Indications of the approach of cyclones." The different kinds of clouds, their heights, their normal movements, and their movements in the presence of a typhoon are very fully discussed, and interesting tables of cloud heights and directions are given. It is also shown that by measuring the heights of the clouds, the inclination of the axis of the typhoon, and, therefore, its dangerous quadrant, can be determined.

Algué's barocyclometer for determining the probable position of the center of the cyclone, the swell of the cyclone, and the cyclone or storm wave are among other subjects considered.

Section III considers at length characteristic cyclones of various types, and the fourth and last section treats of "Winter storms or land storms," that approach the China Sea from the Continent of Asia.

While, as stated above, this book is intended primarily as an aid to mariners, it contains much that is of interest to the general student of meteorology.—*H. H. K.*

THE WEATHER BUREAU IN THE WEST INDIES.

It is difficult for us to fully appreciate the extent of the influence of the weather upon the ordinary affairs of life. We know in a general way that pleasant weather helps trade, and that bad weather is injurious to health; that abundant rains mean good crops, but that severe storms often destroy much property. But since we can not control the weather we are quite apt to take it as it comes, with more or less of fault finding if it is disagreeable, to be sure, but without any special effort to prepare for it until it is upon us; a blizzard finds us with empty coal bins, and a rainy day catches us abroad without an umbrella.

Until recent years perhaps this was unavoidable, but with the information now available it ought to be the exception when severe weather finds us unprepared.

It is not enough that people receive the daily weather forecasts sent out by the Chief of the Weather Bureau. A warning of a cold wave means but little to a man who knows nothing of such phenomena, as compared with the man who has studied the movements of these vast masses of cold air across our country. A warning of an approaching cyclonic storm loses much of its value unless the recipient of the warning knows something of the movements of the wind about the cyclone.

The Weather Bureau desires not only to accurately forecast the weather, but also to interest the public in the study of at least elementary meteorology, so that the greatest possible good may be derived from the daily forecasts. It aims to do this not only through the daily weather maps, the MONTHLY WEATHER REVIEW, and occasional bulletins, but also through lectures by its various officials before public schools, colleges, and societies.

The sources of information are so many and varied, and oftentimes there are so many vehicles between these sources and the public that one is in danger of losing sight of the fountain head. The educational value of the Weather Bureau and the advantages to be derived from a knowledge of meteorology are illustrated by the following quotations from the St. Croix Avis, September 14, 1901, edited by John T. Quin, Superintendent of Schools:

The presence of the United States Weather Bureau in these West Indian Islands has doubtless awakened a good deal of interest in the weather in this part of the world, and has added very largely to the number of persons who follow weather changes with intelligent interest. For such, the story of the cyclone through which we have just passed has some interesting points.

From the quite complete history of this storm, as given by the Editor of the Avis, we quote the following:

It may interest amateur observers to mention that the first hint of the recent storm was given by the sky, a careful observation of some high clouds at 5 p. m. on Tuesday, September 10, showing our editor that they were coming from east-southeast. He mentioned the fact and its probable significance to a friend at the time; a couple of hours afterwards the Weather Bureau's telegram arrived. Yesterday (the 13th) the storm having passed, the high clouds were moving slowly from about west-northwest, still coming, that is to say, from the cyclone center.

At 2 p. m., Wednesday, September 11, the following weather notes were issued from the Avis office:

Since morning the editor's aneroid barometer has fallen to 29.89 inches, and the wind has gone round to northwest. These facts mean that the disturbance already reported is passing us to the north and is at present off St. Croix to the northeast. No destructive wind is at all likely, but strong winds from northwest and west are quite possible. The clouds at our end promise rain, which would be very welcome. The wind will probably veer to west, later round through south to an easterly point.

The Avis for October 5, 1901, contains the following rainfall data:

We have been favored with a statement of the rainfall for September at the usual three stations, and combining it with previous returns, are now able to give the following statement of the total rainfall for the year to September:

Total rainfall.

Months.	Christiansted.	King's Hill.	Fredericksted.	Averages.
	Inches.	*Inches.*	*Inches.*	*Inches.*
January-June	19.47	14.34	15.23	16.51
July	15.53	10.39	9.47	11.80
August	2.13	1.64	2.16	1.98
September	12.91	14.47	21.78	16.38
Total	50.04	41.34	48.64	46.67

The average fall from 1852 to 1889 over the same period of the year is 30.91 inches; hence the fall this year up to the present exceeds the average by 15.76 inches. The average fall for September, over the same 38 years, is 6.78 inches, so that last month's average for the island is nearly three times the general September average.

The characteristics of cyclones in general, and especially the determination of their probable paths from the readings of the barometer and observations of the direction of movement of the wind and clouds are discussed in the Avis for October 5 and 26, November 2 and 9.

In the number for November 2 the following extra bulletins were reprinted:

To be on the safe side I think it desirable to publish the following, without intending thereby to cause needless alarm.

The day's weather signs up to the present seem to indicate that a storm center is advancing in about our direction from the west. The wind may become much stronger, and is likely to blow from the west and northwest.

The barometer should be watched, and if it continues to fall preparations should be made to meet possible bad weather. Yesterday it stood at about 30.00, to-day as follows: 7-10 a. m., 29.90; 11 a. m., 29.98; noon, 29.86; 1 p. m., 29.85; 1:30 p. m., 29.84; 3 p. m., 29.82.—Ed. Bulletin. (Extract to Bulletin of October 30, issued at 3 p. m.)

Havana Weather Bureau reports decided barometric depression north-northwest of Porto Rico, storm winds not indicated.

The above shows us where the cyclone center was this morning. The wind direction here was in harmony with this. The center was south of Hayti yesterday and has moved from about west-southwest to east-northeast. It will be at its nearest to us a little later in the day when the wind has gone round to about west-southwest. It is consoling to learn that no storm winds need be expected. Again a cyclone has brought us splendid rains. We do not say our fifth for the month, for

we believe it to be the same as our fourth, namely, that which passed us to the south on the 22d. (Extract to Bulletin of October 31, issued at 2 p. m.)

The assumption that the storm of October 31 was but a continuation of that of the 22d appears to be erroneous. It is not so considered in the October report from the Havana Forecast District, and Form 1001, which contain the monthly reports of meteorological observations, do not indicate that a storm prevailed in the Caribbean Sea and the Gulf of Mexico during the above period. We must consider these to have been two independent storms.

In the Avis for November 9 the editor devotes nearly all his space to a discussion of what he terms "harmless cyclones," or cyclones that are unaccompanied by hurricane winds. He points out, as Professor Bigelow has already done, in Vol. II, Report of the Chief of the Bureau, 1898–99, charts 31 and 35 and pp. 454–457, the difference between the circulation in a genuine West Indian hurricane and in ordinary cyclones, such as are common in temperature latitudes, and are occasionally experienced in the West Indies in winter.

Mr. Quin notes that "when the fall of the barometer announces the approach of a cyclone it is impossible at first to tell whether it is a harmless or a destructive cyclone." It is also noted that the absence of the ocean swell indicates the absence of hurricane winds, but no mention is made of the movement of the upper clouds in these mild or harmless cyclones, and we would suggest that this should be a very important observation. In temperate latitudes the ordinary cyclone, unlike the cyclone with hurricane winds, does not perceptibly deflect the direction of the upper clouds. Is not this also true in the Tropics?

In conclusion Mr. Quin says:

Now some of our readers may ask: What is the use of giving so much attention to a phenomenon which you admit to be without any serious danger; what good does that do to any one?

As one part of the answer, we would say that such a study strengthens our knowledge of the laws of the weather, and may one day be of great practical value to any one of us; and for the rest we would appeal to our fellow amateurs whether it is not an intense pleasure to be able to look out with the mental eye over a vast stretch of ocean and see the probable condition of the weather; to be able to follow one of these mysterious and grand natural movements in its course over seas and islands and to say what is likely to happen as it advances. As we remarked in a recent article, the establishment of the United States Weather Bureau in these West India Islands must increase the number of people who follow with intelligence the movements of cyclonic disturbances of all kinds during the hurricane season, and to such we hope that this rather long article will not be found unacceptable."

The editor of the St. Croix Avis is evidently an enthusiastic student of meteorology, and he is endeavoring to interest his readers in the subject, not alone because it will put dollars into their pockets, but because he appreciates the fact that knowledge of any science broadens one's mental horizon and elevates the man. It has been abundantly demonstrated, however, that a knowledge of meteorology and the ability to forecast the movements of storms is of the highest practical value.

We trust that the editor of the Avis will continue his observations, which we have no doubt will be even more interesting and valuable than at present after the receipt of the nephoscope that he has ordered, and that we may have the privilege of publishing his results.—*H. H. K.*

FRESH LIGHT ON THE ANTARCTIC.

The following quotations are from a review in Nature, vol. 65, page 153, of Louis Bernacchi's "To the South Polar Regions. Expedition of 1898–1900," which is an account of the cruise of the *Southern Cross* by its commander:

Mr. Bernacchi very clearly indicates the character of the antarctic summer, a period of low temperature and high wind, with very frequent fogs and rare intervals of clear weather. He states definitely that Mount Erebus was never clearly visible, merely a glimpse having been had of it—too short to allow a photograph to be taken. On February 19 the ship, as she lay at the ice barrier, was beset with young ice, and broke through with such difficulty that another day's delay would have meant another year.

The specially scientific part of the book is an appendix, though not so called, of fifty pages. It treats of the climate of the south polar regions, terrestrial magnetism, zoology, geology, astronomy, and concludes with miscellaneous notes and a short glossary of ice terms.

In discussing the climate, Mr. Bernacchi founds his remarks on a preliminary study of the observations taken at Cape Adare (latitude 73° south; longitude 171° east), which have been discussed at the Meteorological Office and are to be published by the Royal Society. The winter was not nearly so cold as at continental stations within the polar circle in the Northern Hemisphere, the absolute minimum recorded being —43.5° F. and the mean minimum of the coldest month, August, —22.7° F. On the other hand, the summer is very cold, the absolute maximum being 48.7° and the mean maximum of January (the warmest month, apparently, although there are no values for February), 37.0°; the mean temperature of this midsummer month was only 33° and the absolute minimum 25° F., but a short distance farther south minima below 0° F. were observed early in February. The most remarkable feature, however, was the wind. Windroses are given for each month of the year, showing that the southeastern quadrant of the horizon has an immense preponderance of winds in every month and a monopoly of gales. This is assumed as strong evidence of the existence of a great continental anticyclone to the south; and no doubt that theory is attractive and has much evidence in its favor. But the gales which burst from the east-southeast or southeast were invariably accompanied by a sudden and great rise of temperature, which in eleven cases cited ranged from nearly 14° to more than 44° F. This wind beat against Cape Adare from the level surface of the frozen sea, and does not suggest a foehn effect or an origin in the icy heart of a south polar anticyclone. Does it not rather indicate the passage of a cyclone center to the north and the sweeping in of air from the warm surface of the sea south of Australia? An anticyclone brooding over the southern land would probably tend to turn wandering cyclones eastward along its margin, and the two explanations are thus to some extent compatible.

A HISTORY OF METEOROLOGICAL WORK IN INDIA.

In the introduction to his administrative report for the year 1900–1901, Mr. John Eliot, Meteorological Reporter to the government of India and Director General of Indian observatories writes as follows:

The first part contains a brief history of the record of meteorological observations in India, and of the gradual development and progress of the Indian Meteorological Department. As this is probably the last administration report that I shall submit to the government, and as no connected account of the operations of the department has been published, it has been thought desirable that I should take the opportunity of my last year's connection with the department to prepare such an account, giving the history of the department up to the end of the nineteenth century, including the first twenty-five years of the existence of the department.

Meteorologists throughout the world will regret the retirement of this able investigator from the position he has filled since 1886. A brief synopsis of his history of meteorological work in India, which includes the work done under his own direction, is perhaps the most effectual way of summarizing for our readers the advancements in meteorology that may fairly be credited to Mr. Eliot.

The history of meteorological observations in India may be devided into three periods, as follows:

1. Previous to 1865, or period of local observation.
2. From 1865 to 1875, or period of provincial systems of meteorological observations.
3. From 1875 to date, or period of the present imperial system.

Period 1, previous to 1865.—Mr. Eliot says that amateur meteorological observers in India were confined to a few indigo and tea planters who recorded the rainfall and perhaps the temperature. Almost all meteorological records were therefore made under the direction of government officials; previous to 1865 the observers were usually unskilled assistants, the instruments furnished by the government were unreliable and often improperly exposed, and such records as were obtained were not properly preserved.

In consequence we are dependent for the meteorology of this early period upon the records obtained by the following observatories that were established by the East India Company for purely scientific purposes:

(1) The Madras Astronomical, Magnetical, and Meteorological Observatory.
(2) The Trivandrum Meteorological and Magnetical Observatory.
(3) The Dodabetta Meteorological Observatory.
(4) The Colaba (Bombay) Meteorological, Magnetical, and Time Service Observatory.
(5) The Calcutta Meteorological and Time Service Observatory.
(6) The Simla Meteorological Observatory.

The Madras Observatory was established in 1792. Meteorological observations were commenced in 1796, and have been maintained without interruption to the present time. Hourly magnetic and meteorological observations were commenced in 1822 and 1845, respectively, and were maintained until 1861.

The Colaba, or Bombay, Observatory was established in 1826; meteorological observations commenced in 1841, and have been continued without interruption to the present time.

A meteorological bungalow was established on the summit of Dodabetta, elevation 8,640 feet, and observations began in January, 1847. They were continued until December, 1855. It is proposed to reestablish this station early in 1902.

The Trivandrum Observatory in the extreme south of the peninsula, was established in 1841, and a substation, on the summit of one of the peaks of the Travancon Ghats in 1855. Both observatories have been continued to the present time.

The Simla Observatory was in operation from 1841 to 1845.

The Calcutta Observatory was established in 1853 and the observations have been continued to the present time.

Period 2, from 1865–1875.—It became apparent that the meteorology of India could not be studied satisfactorily through the work of independent observatories. An effort was therefore made to bring all the meteorological work in India under the direction of a general superintendent. The scheme proposed by the Asiatic Society of Bengal was as follows:

1. A superintendent or director for the whole of India, to whom the local reporters should be subject.
2. Local or provincial reporters for each province.
3. Observatories: (*a*) At the headquarters of the provincial governments under the direct control of the provincial reporters. (*b*) At large hospitals and at selected civil stations.
4. Volunteer agency to be utilized as much as possible in order to obtain marine data, and data of the chief planting districts.

This scheme was practically adopted in 1865, except that no general superintendent was appointed. The provincial governments, however, generally appointed reporters, Mr. H. F. Blanford becoming meteorological reporter for the government of Bengal in June, 1867. A system of provincial meteorological departments, independent of each other, therefore came into existence, and, as was to be expected, it proved to be very unsatisfactory.

Period 3, from 1875 to date.—In 1874 Mr. H. F. Blanford was appointed imperial reporter to superintend the work of meteorological observatories over the whole of India, with power to initiate and control the work and expand the department. He took up the work the following year.

After unifying the meteorological work of India, the next step was to coordinate this system with that of other countries adjacent to the Indian Ocean, and with that of Europe. An effort was also made to extend the field of observation so as to cover the neighboring portions of the Indian Ocean, with a view to a systematic study of the dynamics of the monsoon winds of India.

In 1878 Mr. Eliot, as meteorological reporter for Bengal, made his first forecast of the probable character of the monsoon winds for the coming season,[1] and on June 15, 1878, he inaugurated a system of daily telegraphic weather observations from all parts of India. The code used was based on the system adopted by the American Weather Signal Service.

In 1881 a commission that had been appointed to inquire into the Madras famine of 1876–77 pointed out a probable relation between the seasonal distribution of rainfall in India and the sun-spot periodicity, and recommended an investigation of the subject. The work of the famine commission was amplified by Blanford, and among other things actinometric observations were undertaken at Leah, in 1883, and were successfully conducted at Simla from 1889 to 1895.

Also in 1881, Mr. Eliot, as meteorological reporter to the government of Bengal, inaugurated an extension to the system of storm warnings that had been in existence at the port of Calcutta since 1865, and commenced the collection of meteorological reports from the log books of ships entering the port of Calcutta.

Mr. W. L. Dallas, who was appointed scientific assistant in 1882, undertook the work of reducing and discussing for publication the observations taken on the Indian seas and collected by the London Meteorological Office.

In 1883 the publication of a daily weather report and chart for the Province of Bengal was authorized by the government of India.

In 1885 a system of flood warnings was inaugurated for the Nerbudda and Tapti rivers and a forecast for the southwest monsoon rains was issued. This was the first of a series of diurnal forecasts which has been issued and published in the Gazette of India during the past sixteen years.

Mr. Blanford went on furlough in 1886 and Mr. Eliot was appointed to act for him. Mr. Blanford deciding not to return, he was retired, and Mr. Eliot succeeded him as imperial reporter in May, 1889. The work for the next few years consisted mainly in perfecting and extending the system that had been outlined by Mr. Blanford. The following summary by Mr. Eliot will indicate the scope of this work:

(1) The number of observatories working under or in connection with the department furnishing information for inclusion in the daily weather reports and monthly reviews has been increased from 135 on April 1, 1887, to 230 on March 31, 1901. The increase is hence 95 in number, or 70 per cent of the number in 1886–87.

(2) The number of ports warned on the Indian coast has been increased from 15 in 1886–87 to 45 in 1900–1901, an increase of 200 per cent. The system of storm signals has been improved and additional signals introduced to meet defects shown by actual working and experience.

(3) Current weather information is now placed as rapidly before the more important governments and public as is possible under the conditions of Indian telegraphic and postal facilities.

(4) In 1886–87 there were only three daily weather reports issued for the information of government and the public, viz, the Simla and the Bay of Bengal reports of which only the latter was illustrated by a chart. There are now issued five daily weather reports and charts, of which the following give data:

	No. of stations, 1886–87.	No. of stations, 1900–1901.
India daily weather report	97	158
Bay of Bengal daily weather report	20	28
Bengal daily weather report	41	66
Bombay daily weather report	0	54
Madras daily weather report	0	39

(5) The introduction of a uniform system for the registration of rainfall throughout India (more especially the adoption of a common type of rain gage, common hour of registration, and methods of inspection) and for the publication of the data of observation. The number of rain-gage stations has been increased to some extent, chiefly by increase in Rajputana, central India, Baluchistan, Kashmir, and other districts in which the work was previously very imperfectly performed. An important improvement in connection with this was the introduction of weekly rainfall reports and of charts showing the distribution of the rainfall of each season to date, for the information of the government of India.

(6) A large extension of the work of collecting meteorological information relating to the Indian seas. The data now systematically collected are sufficient to enable daily weather charts (daily weather charts of the monsoon area) to be prepared which show the character of the weather changes in the sea area almost as fully as is done for the land area by the charts in the daily weather reports. Pilot charts for the Indian seas are, as a result of this, now prepared and issued by the office.

[1] In July, 1874, Mr. W. G. Wilton had made similar forecasts for the Indian government.

(7) The establishment of a solar physics observatory for the systematic examination and study of the changes in progress in the sun and their correlation with the larger features of Indian meteorology and the transfer of the Magnetic Observatory at Colaba and the Astronomical Observatory at Madras from provincial to imperial control.

The present work of the department and the chief directions in which extension is desirable may be classified under the following heads:

(1) The collection of accurate meteorological data from a sufficient number of representative stations to give the chief facts of the climatology of India and to furnish data for the issue of the various reports and warnings of the department.

(2) Special meteorological investigations.

(3) Seasonal forecasts.

(4) Marine meteorology.

(5) Daily weather reports.

(6) Issue of flood and storm warnings.

The work under the second head admits of very large and special development. Little or nothing is known of the depth of the seasonal atmospheric currents in India. Kite or balloon investigations are hence greatly to be desired. Similarly the relations of sun spots and terrestrial magnetism to Indian meteorology are deserving of a full and careful investigation, for which there is probably sufficient accurate material to enable these questions to be usefully discussed.

A reference to my opinion given in 1878 expresses fully the directions in which I believe now, as then, extension of observation and comparison is necessary in order to increase the value of the seasonal forecasts. Slight extensions have been slowly and tentatively made during recent years, but if further improvement be desired it will be necessary to collect and compare data from a much wider area than has hitherto been possible with the limited available means.

The opinion given in 1878 by Mr. Eliot had reference to "the coordination of the meteorology of India with that of the various countries adjoining the Indian Ocean, and also with that of Europe," for the purpose of studying the two great monsoon currents of India and their possible relation to the variations in the annual rainfall in India, as well as the relation between these variations and the solar radiation and the evaporation over the area which forms the source of the rains of south Asia.

This illustrates the broad policy upon which the Indian Meteorological Office has been conducted during the administration of Mr. Eliot. It is the same as the policy that has led to the expansion of our own Weather Bureau to include reports from the Atlantic and Pacific oceans, Canada, Mexico, Central America, and the West Indies, and from such expansions meteorology is deriving decided benefit.—*H. H. K.*

PAMPHLETS RELATIVE TO WETTERSCHIESSEN.

No. 1. G. Suschnig. Bericht über den Verlauf des dritten internat. Wetterschiess Congresses zu Lyon am 15, 16 und 17 November, 1901.

No. 2. G. Suschnig. Referat über die Erfolge und Beobachtungen beim Wetterschiessen in Oesterreich erstattet dem III. internationalen Wetterschiess Congresse in Lyon am 15 November, 1901.

No. 3. Rudolf Szutsek. Bericht über das Wetterschiessen im Landes-Schiess-Rayon zu Windisch-Feistritz, in den Jahren 1900, 1901. Bearbeitet von Rudolf Szutsek, k. u. k. Oberstlieutenant I. R. Leiter des obigen Landes-Schiess-Rayons. Graz, 1901.

This pamphlet of 16 pages and 2 charts contains a most satisfactory detailed account of the methods and operations at the headquarters of the hail shooting system. It contains the results of careful observations of the hailstorms and of the effect of the shooting. The charts show the irregularity in the distribution of hail from the ordinary storms as well as the irregularities in the movements of these storms, of which there were 8 in 1900, and 7 in 1901. We should say that just as Dyrenforth's explosions of dynamite were observed to be followed by rain, or accompanied by rain, or preceded by rain, according as the observers happened to be in front of, or under, or in the rear of a passing shower, thereby demonstrating its utter inefficiency, so with the cannonading and the hail at Windisch-Feistritz. However, on this latter point Lieutenant Szutsek, on page 14, says:

Although no certain conclusions can be drawn from the previous observations because we have too little material on hand, still the results give some ground for the hope that the question whether hail shooting is efficacious, whose solution the whole world awaits with anxiety, can be answered in the near future.

No. 4. G. Suschnig. Das Wetterschiessen. Graz. 1901.

This is a very interesting general history of the subject from 1750 to May, 1901. It gives an excellent bibliography of the subject and is apparently prepared for distribution at the Congress at Lyons.—*C. A.*

THE THIRD INTERNATIONAL CONGRESS ON HAIL SHOOTING.

On a following page we publish a translation of the whole of the report offered to the Third International Congress at Lyons in November last, by Prof. J. R. Plumandon, Director of the Meteorological Observatory on the Puy-de-Dôme in southern France. The extent to which cannonading against hail has spread through Italy, Austria, and France is well shown by the reports presented at the Congress at Lyons. The general report of the proceedings of the congress has been prepared by G. Suschnig, the indefatigable agent of the iron manufacturing firm of Carl Greinitz and Nephews at Gratz, Austria. According to this publication reports were received at the congress from the following persons:

1. Professor Battanchon on the general history of the subject of weather shooting.

2. Guinand, on the results in France, during 1901, where 39 operators with 834 cannon protected 22,900 hectares. He reported perfect success in every case; on this Suschnig remarks that he is altogether too optimistic, and that his enthusiasm needs to be modified by a careful discussion of the French data such as has already been done for Austria.

3. Suschnig, a general report for Austria. After a short sketch of the literature of the subject since 1750, in Austria, he gives a special description of the present state of affairs in the various provinces of Styria, lower Austria, Krain (Carniola), the Adriatic coast, Dalmatia, upper Austria, the Tyrol, and the Kaernten (Carinthia). In summarizing the results, he states that they have investigated thoroughly the efficiency of the cannon, and the altitude to which the vortex rings ascend, viz., three or four hundred meters. They have also begun a laborious investigation, as yet unfinished, into the laws of the movements of the vortex rings. He is endeavoring to respond to the general demand for accurate data as to the operations themselves. In general, every one is thoroughly satisfied with the results and no one doubts but that systematic shooting has accomplished good results.

4. Konkoly, for Hungary. The experience of the year has shown that the practical service leaves much to be desired, and the reporter, therefore, expresses the greatest reserve in judging of the value of the shooting.

5. Ottavi, for Piedmont, Italy. Although there were many hailstorms yet the stations were generally well protected, but there were three cases of severe extensive damage to the protected as well as the unprotected, namely, on May 17, June 12, and July 22. In many cases the shooting seems to be effective against hail, but in many others not so.

6. Alpe, for Lombardy. The shooting stations generally report good results, but cases of failure are believed to be the consequence of poor organization, feeble cannon or delay in shooting; nevertheless the severe misfortune at Mantua occurred in spite of perfect shooting and can not be excused.

7. Marescalchi, for Emilia.

8. Marconi, for Venice.

9. Bordiga, for southern Italy. These three reports were read by Ottavi and excited considerable discussion on account of their extreme conservatism.

10. Dufour, for Lausanne.

11. Salmones, for Spain.

In both of these countries the weather shooting has been tried only experimentally and to a small extent. It has excited lively interest but has contributed very little to our knowledge of the subject.

12. Gogol-Janoffsky, for Tiflis. This organization is quite recent; shooting was tried on 18 thunderstorm days with surprising results. In previous years the vines were injured more or less by hail four or five times annually, but this year not once. The same was also true throughout the Crimea, but nothing is stated as to whether hail fell on any fields outside of the regions of the protecting cannon.

13. Vidal, of Toulouse, reported on the use of rockets against hail clouds. He quoted 16 cases in which he had applied the rockets. Suschnig says "Although we think that the matter of the rockets has been settled, yet Professor Vidal deserves more attention than the congress gave him because of his service in other directions."

14. Andre, Director of the Observatory at St. Genis-Laval, spoke of the barometric conditions that prevail during a thunderstorm; the advent of a storm in general could be predicted several hours in advance by means of wireless telegraphy, as had been already done at his station and also in Rome.

15. Professor Porro, of the University at Genoa, advised a special service for thunderstorm predictions.

16. Gastine, delegate for the Minister of Agriculture for France reported on the vortex rings and the possibility of their action in hail shooting. He, with Vermorel, had made experiments in Villefranche similar to those made by Suschnig at St. Katharein, near Gratz, and concludes that in the present state of our knowledge of the meteorological processes going on in the clouds, it is impossible to give a definite opinion as to the value of the hail shooting, but that it is very desirable that continuous methodical observations should give us some explanation of the formation of thunderstorms and hail, for our errors and our doubts arise from our ignorance as to these phenomena.

17. Chardiny reported on the relation of weather shooting to the insurance associations, and recommended that the cannoneers be insured against accidents.

18. Deville, for the department of the Rhone, gave the statistics of hailstorms for twenty years, showing that they have done damage to the extent of $1,000,000 annually. He demonstrated that the formation of hail is favored by the slope of the ground and that hail is less frequent in forest regions. He had already delivered a statistical memoir on this subject to the Academy of Sciences in Paris, stating therein that he could not conclude that the vortex rings had any efficiency against hail. He repeated that there is no demonstration of such efficiency, but that there are points upon which we may base a further earnest investigation of the subject.

19. Chatillon, for Villefranche.

20. Blanc, for Denicée, described the operations in their respective regions.

21. Chevallier spoke of the desirability of special legislation and that the regulations with reference to the protection from phylloxera should be extended to cover hail.

22. Picard, as manufacturer of explosives, reported that in France a quality of powder was used that responded perfectly to all demands.

23. Pistoj, major of artillery, reported on the technique of the shooting apparatus. He did not favor rockets and bombs.

24. Marangoni reported on the application of the shooting apparatus to the prevention of frost. Experiments on this subject had given no favorable results.

25. Plumandon delivered a general résumé, which is printed in full on page 35 of this REVIEW.

26. Professor Roberto explained his theory, based on careful observations, according to which hailstorms are simply powerful whirlwinds of air around a horizontal axis; the whirls can be broken up by the vortex rings from the cannon, but only the most powerful apparatus can be useful.

27. After a lively discussion, the congress finally adopted several resolutions, which may be summarized as follows:

A. That protection against hail demands the most earnest attention and study on the part of science.

B. That satisfactory results in hail shooting require the greatest possible extent of stations and uniformity of apparatus.

C. That it is important that the central meteorological stations should send to the local organizations for hail shooting earlier notices than now of the approach of thunderstorms, and furthermore that investigations by meteorological observatories into methods of protection against hail must be encouraged as much as possible.

D. The congress recommends the formation of a permanent international committee, whose problem it shall be to bring together all persons and societies interested in the subject; to publish the proceedings of this third congress, and to call together a fourth congress at the proper time. About twenty persons were appointed on this committee, including such eminent meteorologists as André, Plumandon, Pernter, Konkoly, and Dufour.

It was resolved that the thanks of the congress be expressed to all the governments who have taken an official part in it. An exhibit of apparatus was held during the session of the congress, but, in general, only smaller apparatus from French manufacturers were shown. The very extensive exhibit of Carl Greinitz and Nephews was assigned to the section on science and investigation, but unfortunately arrived too late to be examined by the jury of awards, which, indeed, did not visit this section at all. Certain members of the jury protested that, in the present experimental stage of the whole subject, it was not proper to make any classification of the various systems of shooting apparatus; that, in fact, none of those exhibited compared in efficiency with those made in Gratz, and that no diploma should be given except one of encouragement to all manufacturers alike.

Suschnig states that in the competitive trials in the presence of the jury, accidental explosions occurred necessitating the amputation of the right arm of the operator, and he adds that similar sacrifices have already become too numerous. In Venice and Lombardy alone there have thus far occurred five deaths and thirty severe accidents, so that the prefect of the Vicenza has forbidden any further shooting.

At the conclusion of the report Suschnig put on record the fact that about a month before the Congress at Lyons a National Italian Congress had been held at Novara, at which the Italian delegates to the Lyons Congress had been elected and had been instructed as follows:

> The Novara Congress finds that the good results of hail shooting during the years 1899 and 1900 have only held good, for the season of 1901, in those places where the shooting has been conducted rationally and with sufficiently powerful apparatus and where thunderstorms of unusual severity have not occurred.

He gave also some details as to the reports relative to Novara by Professor Pochettino of Rome, Professor Rizzo of Perugia, Brucchietti of Rome, Vicentini of Padua, all of which agree in showing that scientific questions as to the real efficiency and best methods of shooting must be decided by experts, and can not be profitably discussed in these general congresses. He concluded by saying that the Congress at Lyons made an excellent impression upon every one as to its sober consideration of the facts and arguments against the efficiency of hail shooting. There were no dramatic scenes and no trace of any effort to avoid scientific operations; there

was no disturbance as the meteorologists developed their views on the subject. Suschnig says: "it was as though recognition and thanks were due to science," and he adds, "It is to be hoped that the spirit which prevailed in this congress may also inspire future congresses on this subject.

It is indeed true that "recognition and thanks are due to science," for if it had not been for the strenuous demand on the part of scientists in Europe and America that this hail shooting delusion should be examined into carefully and treated from a common sense point of view, we might have beheld the Congress at Lyons promulgating a series of illogical and erroneous conclusions leading to a great waste of money and loss of life consequent upon the general adoption of the erroneous views that have spread so rapidly from Styria and Italy into southern France.

Errors, like ignorance, are always expensive. Science is only another word for truth and intelligent common sense. On account of the difficulties of scientific research it may cost $100,000 to demonstrate some truth in nature, but when once attained such truths become the basis for an immense amount of saving in time, labor, money, and life. The sole object of the scientific world is to get at the laws of nature in order to serve the best interests of mankind. Of course this often mean iconoclasm as to old ideas and methods, but we who live on the earth, breathe its atmosphere and rejoice in its sunshine and cloud, can not afford to be ignorant of the laws of the material world around us. It would be a sad commentary on the civilization of France if the nation that has so greatly profited by accepting the wonderful results of the researches of Pasteur should make itself ridiculous by rejecting the equally important work of its famous meteorologists.—*C. A.*

GENERAL REPORT ON HAIL SHOOTING PRESENTED TO THE CONGRESS AT LYONS.

By Prof. J. R. PLUMANDON, Meteorologist of the Observatory of Puy-de-Dôme.

[Translated by Mrs. R. S. HOTZE.]

Allow me, in the first place, to express my regret that an unfortunate illness has deprived our congress of the valuable assistance of M. Houdaille, whom I have not the presumption to pretend to replace. In 1900 M. Houdaille was appointed by the minister of agriculture to make a series of studies in the wine regions of upper Italy, where the struggle against hail had already attained extraordinary development. In the course of his mission he collected numerous and important documents on all the points relating to this question, and particularly on the efficiency and the organization of the firing of cannon against hail clouds; he then summarized the publications on the subject which had been communicated to him, as well as his own personal observations, and issued, through his publisher, Alcan, a book filled with enlightened ideas and profound and accurate observations. Better than anyone else was M. Houdaille fitted (and he proved it in effect) to continue and bring to a happy conclusion the work that he had so well begun.

It was therefore not without much hesitation that I consented to accept the perilous honor of attempting to fill his place. I was induced to do so, first, by the extreme kindness of our president, M. Burelle, and of our general secretary, M. Silvestre, and, finally, I relied upon your indulgence, hoping that my twenty-five years of study of storms and hail would excuse my temerity.

Moreover, in the accomplishment of my task, which has already been facilitated by the eminent reporters who have preceded me, I shall have in view only an impartial search for truth, and I have already had the satisfaction of finding that on all important points my opinions agree with those of M. Roberto, the learned supervisor of education of the Province of Alessandria, who is charged with a report similar to my own.

I have followed the reading of the reports with the greatest attention and have also studied them at length. I have purposely abstained from taking an active part in the discussion of these reports in order that I may consider them as a whole without any personal feeling and thus maintain the most absolute impartiality.

If we wish to judge of the results obtained against hail by the discharge of cannon, fusees, petards, or any other method which has for its object the combatting against storms, it is, of course, necessary to be acquainted with the experiments that have already been made. But it is none the less necessary to have in addition and above all, apart from all preconceived theories, rational ideas of the atmospheric conditions which produce hailstones. It is, moreover, almost indispensable, not only to have personally observed a great number of storms, but it is also and perhaps still more necessary to have studied them in their relations to the general conditions of the atmosphere. This implies the habitual use of the daily charts which show both the absolute and the relative values of the principal meteorological elements in their relation to thunderstorm phenomena. But be not alarmed, I am not going to theorize. In the question with which we are occupied you very rightly place facts above all else. I will invoke only these facts, and among them we shall find some that justify the struggle that you have entered upon against hail.

In the remarkable reports that have been communicated to us all the facts are interesting, but not all in the same degree, especially when it is desired to invoke them as proximate proofs of the efficacy of the firing of cannon to prevent the fall of hail. Let us take, for example, a case which has been frequently observed: In a locality well organized for defense, a storm approaches unexpectedly. By the blackness of the cloud, the darkness produced by it, the intensity of the lightning, and the continuous roll of thunder coming nearer and nearer it seems as though it must acquire extraordinary violence, and menace the region with disaster. The artillerymen are at their posts, and fire the cannon methodically. Soon the strength of the storm diminishes and it passes away, discharging over the region only a rain that is more beneficial than harmful.

Is it the firing of the cannon that has dissipated the storm? This is not absolutely impossible, but who can affirm that it is so, since dissipation occurs very frequently without any cannon at all being fired? It would be necessary to have a very large number of favorable observations in order to place any confidence in such a bold assertion. It is about the same with those assertions that attribute to the influence of the cannon shots various occurences that may really be quite independent of it, such as the diminution of the violence or the frequency of the wind, of lightning, thunder, or hail, the dispersion or deflection of storm clouds, etc.

As proof positive of the influence of the firing on hailstorms the falls of snow observed in a certain number of localities during storms combatted by cannon have often been cited. It is said that the repeated discharges of the cannon transformed the hail into snow, or at least that they prevented the formation of hail and allowed only the formation of snow. Here again the proof is not sufficient, and these falls of snow are not necessarily the result of the firing, as they are also observed during storms against which no cannon have been fired. Moreover, they are of more frequent occurrence than is generally supposed, particularly in mountainous regions where they accompany a part of the storms of spring, autumn, and sometimes those of summer.

Snowstorms are of more frequent occurrence the higher we ascend in altitude, or the farther north we go in latitude, or

again, the farther the season under consideration is from midsummer. This is very reasonable. But in our temperate climates they also occur at all seasons and at ordinary altitudes. In France, at the level of the slopes where the vine is cultivated, they are not of yearly occurrence, although according to observations of the Central Meteorological Bureau that I have consulted, they are very nearly so, since from 1891 to 1898, it was only in the year 1893, which was extremely warm, that they did not occur. During this period of seven years, snowstorms were experienced on 32 different days, and it was precisely in the wine regions of the Rhone, Beaujolais, and Mâcon that they were most frequent. It is in these regions also that they occurred at the seasons nearest midsummer.

Moreover, the above figures give only the minimum values, since all the localities do not cooperate with the meteorological service, and many snowstorms have certainly occurred that have not been reported. For example, I have discovered the following dates in some scientific publications: The storm of August 27, 1896, at Albertville (422 meters) and at Ferté Macé (206 meters) in the department of the Orne; one on September 19, 1897, at Havre, and on July 31, 1893, at Ghent, where the snowflakes were as large as a franc piece. By making more careful investigations we should discover many other cases, and if we do not meet with them more frequently it is because in summer the flakes generally melt in the lower strata of the air.

On the whole, one is obliged to admit that according to all observed facts, when snow occurs in summer it is always during thunderstorms, so that these latter, notwithstanding the heat which precedes them, seem to favor the fall of snow. This is certainly true, and moreover it is easily explained. The warm ascending currents that give rise to thunderstorms at first produce rain or hail, but in proportion as these currents become weaker and exhaust themselves, the cold of the upper strata finally overcomes them and congeals the aqueous vapor into snow, and this the more easily the higher they have risen. On the other hand, the storms themselves, by intermixing the strata of air piled one above the other from the surface of the earth up to a very great altitude, produce, as is well known, a general cooling; if this cooling is sufficiently great the snow will descend to the surface of the earth without melting, thus causing a very natural surprise, such as was produced at the time of the firing of cannon in the vine countries of France and of northern Italy.

In conclusion, we see that even admitting that the cannon produce a certain effect upon thunderstorms, we could not attribute to them the production of snow absolutely, and still less, of course, the change into snow of a hailstone already formed. The hailstone once formed of ice more or less hard, can only be destroyed or rendered softer by the action of heat; if the melting is complete, it then turns into rain, but sometimes into a soft hailstone if the ice composing it is not sufficiently homogeneous and is only partially melted.

It is moreover probable that the greater number of soft hailstones are formed directly. For this purpose it suffices that small masses of water in an unstable state of surfusion be found in the midst of the storm vortices, and that then congelation should take place as the effect of a shock against another mass of water, or an ice crystal, or a snowflake, or even simply under the influence of a too abrupt movement. If the general temperature of the mass of water in surfusion is not sufficiently low to solidify the whole, there remains some water imprisoned between the crystals that are formed and the result is soft ice that may be crushed under the least pressure.

The surfusion of water and the formation of soft hailstones may be produced without much difficulty by taking a few precautions, but I have often observed their spontaneous formation while making use of the psychrometer to determine in winter the hygrometric condition of the exterior air at the observatory of Puy-de-Dôme. The water which serves to moisten the muslin of the wet thermometer is contained in a small cylindrical porcelain vase of a capacity of about 30 cubic centimeters. This vase rests habitually upon a small iron shelf fixed alongside of the thermometer shelter, in order that the water may be about the temperature of the circumambient air, and it is exposed to the natural cooling that may be produced by convection or by radiation. As the cooling takes place especially at the bottom, which is in contact with a metallic mass that is a good conductor of heat, the water is not agitated by eddies and may remain liquid even when its temperature is lowered to a little below zero; it is precisely this phenomenon which produces the surfusion of water. But when the bulb of the thermometer, which must be wet in order to make the psychrometric observation, is dipped into this surfused water, the 30 cubic centimeters of water is suddenly transformed into ice that resembles half-melted snow, because it imprisons an excess of water that is not solidified. This slushy ice is nevertheless sufficiently solid to remain attached to the thermometer. Thus, one obtains almost instantaneously a sort of soft hailstone, similar to those that fall during certain storms.

Here then we have a series of facts upon which, it seems to me, too much reliance has erroneously been placed as proving beyond all doubt the efficiency of cannon against hail. Fortunately, there are other facts which, although they still leave much to be desired, yet, nevertheless, have more weight than the preceding.

Among these is the general and persistent diminution of the damage caused by hail, and which is considered as a consequence of the firing. Nevertheless, while it is very real, thi diminution might still be only a coincidence. In effect, even for very extensive regions, and long before the firing of cannon had developed, long series of observations had shown that the number of falls of hail, as well as the extent of the damage inflicted by them, are subject to considerable variations, sometimes in one direction sometimes in the other, not only from year to year but during several consecutive years. Here is an example: The number of meteorological stations in the department of Puy-de-Dôme which suffered damage from hail each year, from 1886 to 1892, was 72, 32, 4, 18, 8, and 37, respectively. If the protection of crops by cannon had been organized there in 1887, it would certainly have had attributed to it this enormous diminution of damage which lasted five years.

If we consider only a restricted region, and particularly a single locality, we get still more fantastic or perplexing results. Thus a small commune may not experience any notable losses from hail for eight or ten years, and then again it may be ravaged by it for three or four consecutive years.

What now is to be said of the strokes of lightning that have occurred during the firing within the protected zones? What conclusion is to be drawn from the more or less complete disasters that have occurred notwithstanding five or six thousand discharges of cannon, if not that they weaken the argument for the usefulness of cannon as much as the favorable cases strengthen it?

Of course this does not indicate positively that the firing of cannon fails to produce any effect on hailstorms, but simply that the preceding facts do not suffice to prove such action.

It is much more encouraging to cite the following among the statements which justify attributing some influence upon thunderstorms to the firing of cannon:

1. The sudden suppression of hail over the immediate borders of a region protected by cannon.

2. The immunity enjoyed by a protected region while all the surrounding territory, or at least a part of the region immediately adjoining it, is ravaged by hail.

3. The destruction wrought in a small nonprotected zone inclosed within a vast extent of country where the cannon have worked well and which has not suffered any damage.

These facts have been attested by different reporters and they have been brought to my attention more particularly by Mr. Roberto who guarantees their authenticity.

But even for these three cases which seem to testify so eloquently in favor of the useful results of the firing, it is still necessary to make some reservations. In effect, when one has at his disposal a large network of meteorological stations very near to each other, very instructive facts relative to the distribution of hailstorms can be established.

When a storm is of great extent, or rather, as happens most frequently in viticultural regions, which are always rather hilly, when a certain number of storms (which seem indeed to make only one) burst nearly simultaneously, we recognize by studying the observations made (1) that one, two, or several regions get the hail either over the whole of their territory or, at least, over greater or less portions of it; (2) that analogous groups do not get any hail, either on the whole or on larger or smaller portions of their territory; (3) that the two classes of groups are in some way or other confused one with the other. In such a case, it is very difficult to judge as to the efficacy of the cannon discharges by the limits of the hail falls. Indeed, if it is the communes that have organized the shooting that have escaped, they will be apt to say that they have been protected by the cannon; if, on the other hand, it is these communes that have been hailed on, then to be logical it must be said that it is the firing of the cannon that has caused the hail to fall. In the case of a commune that is only partially affected by the hail, one is free to think as he pleases.

Nevertheless in all of these three cases the cannon may have had nothing whatever to do with the effects noted. In every case, the utility of cannonading is, of course, much more probable if the immune surfaces coincide exactly with the protected regions and if the ravaged districts also coincide with the non-protected regions, always, however, on condition that these facts be proven a great number of times without serious or frequent exceptions.

Certain less common types of storms have, however, furnished a surer means of control, viz, those which being completely isolated and possessing, so to speak, an individuality, deposit hail along a narrow and rather long strip of country. A complete immunity from disaster in a portion of the strip protected by cannon, or at least a complete cessation of its ravages at the boundaries of the protected zone, would justify the hypothesis of a protecting influence. But here again, this justification would have to be verified a great number of times.

On the whole, among the facts invoked in favor of the efficacy of the cannon shooting, there are some that prove absolutely nothing, others that are unfavorable, and only a few can be made to serve as a foundation for the hypothesis of the protecting influence. This is really good progress in such efforts. The too enthusiastic persons who have believed in the prompt and radical suppression of hail will certainly be disappointed, as is always the case when one discounts too highly the success of an enterprise. But the more moderate ones will be satisfied with the single idea that the struggle against hail is not absolutely impossible.

Moreover a great impulse has been given. The enthusiasm which began in Italy has spread into France. It remains to find out how to direct it, to regulate without lessening it, in order to render it useful and profitable. For this purpose, it is first necessary to be well convinced that in all experiments whose purpose is to act upon nature, time is a factor of the greatest importance. To wish to proceed too rapidly, imprudently, and without method, is to invite defeat. A great deal of money, an immense amount of good will and work would be lost if people allowed themselves to be carried away by the very natural, but too human and often illusory, desire of gaining the victory with the least delay.

When we have seriously studied thunderstorms in their causes and effects, with the aid of all the necessary documents; when we are able to account for the grandeur and extent of the forces that produce them and regulate their course; when we know the immense energy developed by them, it seems difficult, almost impossible—especially after the experiments made by MM. Pernter and Trabert, Castine and Vermorel—to admit that the sonorous vibrations produced by cannon, bombs, fusees, petards, etc., any more than those made by the annular vortices thrown out by the cannon, can have a *mechanical* force sufficient to destroy such formidable phenomena or to restrict their powers of destruction. Nevertheless, Mr. Roberto, whose great scientific attainments are well known, believes that he can prove the possibility of accomplishing it.

But the explanation of the efficacy is not the principal point in this question. Whether this efficacy be the result of a still mysterious influence, perhaps electric, unless it be some other; whether science at present can or can not explain this influence, we will not at present discuss. From a practical point of view what is above all most important to establish clearly, and as promptly as possible, is that the firing of cannon does really protect the crops from damage by hail. Once this is proved, people may explain it if they can, but they will first *profit* by it, and it is the practical advantages that one should look to at present. On account of the paucity of convincing scientific facts, or perhaps better—in order not to wound just susceptibilities—on account of the still insufficient number of convincing facts, it will be necessary to make new experiments, and I am happy to be able to state that on this point I find myself in agreement with all or nearly all of the reporters who have preceded me. These experiments may be made decisive within a very brief period; but in any case they will become so sooner or later if we follow as closely as possible the principles of scientific methods and refuse to accept any fact, and above all any conclusion, without having first submitted it to a rigorous criticism.

I will take good care not to give any advice as to anything relating to the technical part of the firing. In this branch I should have everything to learn from those who have organized and directed it with so much ability; but I will take the liberty of calling your attention to some ideas which have been suggested by my long study of storms.

One of the first conditions to be complied with will be to establish in the regions chosen for the definitive experiments, a perfect service of meteorological observations, with the active cooperation of the Central Bureau and the meteorological committees. Leaving the exactitude of these observations out of the question, they will be of more value in proportion as the stations are more numerous. It will be necessary to have one station in each commune over a total area equal at least to that of a department, in order to be able to follow up some of the storms from their first beginning to their dissipation.[1] As a private individual can scarcely know accurately anything more than what takes place in the small region around him, it would be well if these stations were placed under the direction and management of the communal officers. They would thus succeed without trouble in furnishing accurate, complete, and well authenticated information in regard to all the phenomena relating to storms throughout the whole commune. The great practical interest that attaches to this question of hail would certainly ensure the active cooperation of each municipality.

Again, the disposition of the cannon over the region to be protected would have to be regulated. Evidently, if the cannon had a sure and indisputable protecting influence, there would be nothing to do but to distribute the greatest possible number over the region, being guided, of course, by the pecuniary results. But it is necessary not to lose sight of the fact that

[1] French communes and departments compare to American townships and counties.

the efficiency of the shooting is far from having been demonstrated to the satisfaction of every one and our object is precisely to prove it to all.

During the past year, two particularly interesting communal organizations have been formed in France: (1) At Denicée (by Messrs. Guimand and Blanc) where 52 cannon have been placed about 500 meters apart, in such manner as to form a regular defense over the whole surface of the commune, the geometrical outline of which is almost that of a rectangle twice as long as broad; (2) at Saint-Gengoux-le-National and Burnand, where the attempt has been made to place the cannon along the ordinary trajectory of the thunderstorms. In the north of Italy, a certain number of excellent installations have been made according to the same principals.

The Denicée type, for example, would have to be developed, and it would be advantageous to organize a regular continuous defense over a territory sufficiently vast in proportion to the area covered by the storms, and comprising a group of as many contiguous communes as possible. This has already been done by Mr. Chatillon, in the region of Beaujolais; he has established 18 shooting stations with a total of 340 cannon and covering an area of 10,000 hectares. There should in addition be selected other communal groups without cannon, but presenting about the same agricultural and topographical conditions as the preceding, and thus, by a simple comparison, it would be seen whether the storms in general behave any differently in the two groups of communes. This, of course, would not prevent the ordinary observations from being made.

The Saint-Gengoux type lends itself to a still more interesting modification. Suppose that it should be desired to make an application of this type in the department of the Rhone, which would be perfectly appropriate for the purpose, by reason of its extent, its geographical position, its topography, the serious damage that it sustains each year, and also on account of the cannon that are already established there.

In this department, as also in many others, the storms move in general from the west-southwest to the east-northeast, or perhaps rather from the southwest to the northeast. If the defense were organized by multiplying the cannon in that direction, and consequently diminishing the number in the other directions, the habitual limited breadth of the storms would cause them to pass nearly always either to the right or the left of the line of defense; they would touch it lightly sometimes, but would rarely reach it completely. The action of the cannon would then, however, be very difficult to interpret, and one would often be exposed to unfortunate illusions, and sources of error that would seriously diminish the value of the experiments.

On the other hand, these grave defects could be avoided by extending the line of defense over a long strip of territory which should be perpendicular to the ordinary direction of progression of the storms. This strip of country might be of any desired width, but should above all be quite long in order that a large part of the storms should be obliged to cross it. Thus good comparisons would be obtained between the effects produced by the storms in this protected strip, and those that they caused before they encountered the cannon, and after they passed them.

Many improvements will still be introduced into the methods of protection from hail, by experienced persons who have directed the former experiments. But there is one fault that they should carefully avoid falling into, namely, that which would result from the dissipation of our energy. It would be puerile and injurious to multiply incomplete organizations which would do no good and would conduce to discouragement. At present, all efforts should be directed to a single end—to proving in an irrefragable manner the efficacy of cannon shooting against hail; and for this purpose it is necessary to accumulate well authenticated facts. The enthusiasm that you have manifested proves to me that it is not necessary for me to bid you be of good courage. To the work then, and let us hope for victory.

WEATHER BUREAU MEN AS INSTRUCTORS AND LECTURERS.

We print herewith the outline of a course in climatology that is being given by Mr. A. E. Hackett, Section Director, Columbia, Mo., to students in the University of Missouri. With regard to the method of instruction, Mr. Hackett says:

> In making the various charts the data is read by the instructor and copied upon blank maps by the students, the isotherms and other lines being drawn during the week.
>
> A 15-minute quiz is given each week upon the charts and lecture of the preceding week.

A FOURTEEN WEEKS' COURSE IN CLIMATOLOGY.

[Confined to a study of the climate of the United States.]

FIRST WEEK.

Lecture.—How the atmosphere is heated; brief reference to the principles of conduction, convection, radiation, and reflection, the amount of solar heat received by the Northern Hemisphere at different seasons of the year, different effects upon land and water surfaces, diurnal fluctuations of temperature, effects of ocean currents and large bodies of water upon the temperature of adjacent lands, effects of altitude, prevailing winds, etc., conduction of heat in soil; *how the temperature of the air is measured; how the normal temperature for any place is obtained.*

SECOND WEEK.

Chart work.—Annual mean temperature of the United States.

THIRD WEEK.

Chart work.—Normal temperatures for January and July. A chart showing amplitude, to be made during the week.

FOURTH WEEK.

Chart work.—Highest and lowest temperatures on record. A chart showing extreme range of temperature, to be made during the week.

FIFTH WEEK.

Chart work.—Annual curves of temperature at selected stations; comparing the seasonal march of temperature in different sections of the country.

SIXTH WEEK.

Chart work.—Annual curves of temperature at selected stations.

Lecture.—Causes of differences in annual curves.

SEVENTH WEEK.

Chart work.—Continuance of daily mean temperature above 50° and below 32°.

EIGHTH WEEK.

Chart work.—A series of three charts illustrating the progressive movement of cold waves; remarks by the instructor.

NINTH WEEK.

Chart work.—Average annual precipitation in the United States.

Lecture.—Effects of prevailing winds and mountain ranges upon precipitation; how precipitation is measured; excessive precipitation, etc.

TENTH WEEK.

Chart work.—Seasonal precipitation (four charts, the average seasonal precipitation being entered for each State).

ELEVENTH WEEK.

Chart work.—Average number of rainy days for the year. Normal relative humidity.

Lecture.—What is meant by "relative humidity;" how humidity observations are made.

TWELFTH WEEK.

Chart work.—Average seasonal snowfall and average cloudiness.

Lecture.—How snowfall is measured; water equivalent to snow; importance of snowfall in subarid regions; extent to which a covering of snow protects the ground from frost.

THIRTEENTH WEEK.

Chart work.—Average dates of first and last killing frosts.

Lecture.—How frost is formed; methods of protection from frost.

FOURTEENTH WEEK.

Lecture.—Comparison of temperature and rainfall of the United States with that of other countries of the globe, illustrated by charts.

At Buffalo, N. Y., on January 8 and 10, the class in physics from the local high school, and on January 25 the physical geography class from the high school at North Tonawanda, N. Y., visited the Weather Bureau office. The theory and use of the various meteorological instruments, the construction of weather maps, and other features of the work of the office were explained to the students by Local Forecaster David Cuthbertson, who considers these official visits of more practical value to the students than formal lectures at the school.

At Indianapolis, Ind., on January 11, the physical geography class of the Shortridge High School, and on January 23 the pupils of grade 8A, from public school No. 8, visited the Weather Bureau office. Section Director W. T. Blythe explained the various meteorological instruments, and the manner in which observations are made, collected, and charted, so as to be available for forecast and study purposes.

Mr. F. H. Clarke, Local Forecast Official, Scranton, Pa., reports that he has delivered addresses before farmers institutes in Pennsylvania, as follows: December 5, 1901, at Montrose, Susquehanna County; December 6, 1901, at Madisonville, Lackawanna County; December 7, 1901, at Clarks Summit, Lackawanna County; December 13, 1901, Factoryville, Wyoming County; December 20, 1901, at Waymart, Wayne County; January 6, 1902, at Weatherly, Carbon County; and on January 11, 1902, at Sciota, Monroe County.

Mr. Clarke outlined very briefly the method by which weather information is collected for use at the various Weather Bureau offices in making daily forecasts, and urged upon the the farmers the importance of keeping a record of local weather signs, or changes in wind direction, cloud forms, etc., that precede changes in the weather, to supplement the forecast issued by the Weather Bureau.

Mr. J. Warren Smith, Section Director, Columbus, Ohio, delivered an address, illustrated with stereopticon views, in the auditorium of the high school, Mount Vernon, Ohio, on January 24. The account of the lecture that appeared in the Mount Vernon Daily Banner of January 25 indicates that Mr. Smith covered a wide field in his lecture, "Mountain meteorology," "Meteorology in the arctic regions," and "The sections of the globe having the highest and lowest temperature" being discussed, as well as the instruments and methods employed by the United States Weather Bureau in its work. The conditions that produce thunderstorms, tornadoes, rain, snow, and hail were also explained, and the destructive effects of hurricane winds were shown by means of views.

Mr. Charles Stuart, Observer, Spokane, Wash., lectured before the faculty and students of the Washington State Agricultural College at Pullman, on January 29, on "Weather changes and their causes." A barometer was exhibited and explained.

Mr. Charles E. Linney, Observer, Chicago, Ill., spoke before the Cook County Farmers Institute at Chicago Heights on January 31, his subject being "The Weather Bureau and how to use it." The history of the development of the Weather Bureau was outlined, the various phases of its forecast work explained, and also the manner in which these forecasts could be made most useful. Charts were used showing the development and progress of typical storm areas, and a few meteorological instruments were displayed.—*H. H. K.*

THE WEATHER OF THE MONTH.

By Prof. Alfred J. Henry, in charge of Division of Records and Meteorological Data.

CHARACTERISTICS OF THE WEATHER FOR JANUARY.

From the 1st to the 20th mild, pleasant weather prevailed; thereafter, especially during the closing days of the month, much rain, sleet or snow, and stormy weather were experienced in the lower Mississippi and lower Ohio valleys and generally east of the Appalachians.

The month, as a whole, may be characterized as warm and dry, there being but two important exceptions, viz, (1) the temperature was below the average in Florida, the east Gulf, and South Atlantic States, and (2) the precipitation was above the seasonal average in Arkansas, Kentucky, and locally in the lower Lake region.

There were no unusually severe cold waves.

In connection with the general character of the weather of the month, attention is called to the fact that from the 1st to the 20th the lows moved across the country along the northern boundary, and that pressure over the interior and southern districts was relatively high. It has been noticed in previous years that mild, pleasant weather is almost invariably associated with high pressure to the southward and a movement of lows along the northern circuit. It is not often, however, that such a condition persists as long as three weeks. This type, if we may call it such, was followed on the 19th by a southerly type, and the latter persisted until the end of the month.

PRESSURE.

The distribution of monthly mean pressure is shown graphically on Chart IV and the numerical values are given in Tables I and VI.

Chart III presents for the first time the monthly mean values reduced to sea level under the Bigelow system of reductions, which went into effect on January 1, 1902. The important feature on Chart IV is the great ridge of high pressure extending northwestward from the south Atlantic coast to the

coasts of Washington and Oregon. In a normal month this ridge is broken in the Mississippi and lower Missouri valleys, nor does it extend so far to the northwestward over the coasts of Washington and Oregon as in the current month.

As compared with normal pressures, computed under the new system, pressure during the current month was above normal in all the districts save the Canadian Maritime Provinces, southern California, and southwestern Arizona. The most pronounced departures from the normal occurred in British Columbia and thence southeastward to Wyoming and Colorado. Over this area mean pressure ranged from 0.12 to 0.20 inch above the seasonal average.

TEMPERATURE OF THE AIR.

The distribution of monthly mean surface temperature, as deduced from the records of about 1,000 stations, is shown on Chart VI.

Along the Atlantic coast from southern New York to Florida, and generally east of the Appalachians and in the lower Mississippi Valley, temperature ranged from less than a degree to 3° below the January normal. Temperature was also below normal in middle California; elsewhere the temperature was above the seasonal average by amounts varying from a few degrees in the Southwest to 15° in the Saskatchewan Valley. Generally, throughout the upper Mississippi and Missouri valleys, temperature was from 8° to 10° above the seasonal average.

Maximum temperatures of 80° and over were recorded in Florida, southern Texas, Arizona, and southern California. In the interior of the continent north of the Lake region the maximum temperature of the month barely exceeded 32°. The line of zero temperatures for January, 1902, was a trifle farther south than in the corresponding month of 1901. Freezing temperatures were recorded as far south as Tampa and generally along the Gulf coast, except in southern Louisiana. The lowest temperatures of the month were recorded in the mountain regions of Wyoming.

The average temperature for the several geographic districts and the departures from the normal values are shown in the following table:

Average temperatures and departures from normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	8	24.6	−1.0	....	....
Middle Atlantic	12	30.5	−2.0	....	....
South Atlantic	10	43.9	−2.7	....	....
Florida Peninsula	8	57.4	−2.4	....	....
East Gulf	9	48.3	−1.5	....	....
West Gulf	7	46.4	−0.2	....	....
Ohio Valley and Tennessee	11	33.6	−0.7	....	....
Lower Lake	8	24.9	−0.4	....	....
Upper Lake	10	20.9	+3.3	....	....
North Dakota	8	13.4	+8.7	....	....
Upper Mississippi Valley	11	25.4	+4.3	....	....
Missouri Valley	11	26.4	+5.9	....	....
Northern Slope	7	23.3	+5.8	....	....
Middle Slope	6	30.8	+1.8	....	....
Southern Slope	6	39.5	+1.2	....	....
Southern Plateau	13	38.5	+2.2	....	....
Middle Plateau	9	25.1	+1.6	....	....
Northern Plateau	12	26.9	+1.8	....	....
North Pacific	7	39.5	+0.6	....	....
Middle Pacific	5	45.9	−1.2	....	....
South Pacific	4	52.1	+1.6	....	....

In Canada.—Prof. R. F. Stupart says:

The temperature was about 2° below the average over the greater portion of British Columbia, and 1° to 2° below in the extreme southern portion of Ontario; elsewhere throughout Canada it was above the average, exceptionally so from the Rocky Mountains to Lake Superior and well above in the Maritime Provinces. The excess amounted to from 9° to 14° in the Territories and Manitoba and from 3° to 5° in the Maritime Provinces.

PRECIPITATION.

The month as a whole was unusually dry. In very few districts did the precipitation equal or exceed the average. Less than an inch of rain fell over the greater portion of Florida, southern Georgia, and the southern portion of South Carolina. The deficiency in the Gulf States was equally marked. The only regions in which there was an excess of precipitation are northern Arkansas, Kentucky, the southern portion of West Virginia, and the extreme western part of New York State. On the Pacific coast less than half the normal amount of precipitation was recorded.

Average precipitation and departure from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		*Inches.*	*Inches.*
New England	8	2.26	56	−1.8	....
Middle Atlantic	12	2.58	72	−1.0	....
South Atlantic	10	1.58	37	−2.7	....
Florida Peninsula	8	0.50	18	−2.3	....
East Gulf	9	2.29	44	−2.9	....
West Gulf	7	2.35	68	−1.1	....
Ohio Valley and Tennessee	11	3.24	76	−1.0	....
Lower Lake	8	1.75	66	−0.9	....
Upper Lake	10	0.75	37	−1.3	....
North Dakota	8	0.21	34	−0.4	....
Upper Mississippi Valley	11	0.97	55	−0.8	....
Missouri Valley	11	0.81	80	−0.2	....
Northern Slope	7	0.20	29	−0.5	....
Middle Slope	6	0.36	42	−0.5	....
Southern Slope	6	0.13	14	−0.8	....
Southern Plateau	13	0.69	58	−0.5	....
Middle Plateau	8	0.54	47	−0.6	....
Northern Plateau	12	0.89	42	−1.2	....
North Pacific	7	5.53	67	−2.7	....
Middle Pacific	5	1.53	28	−3.9	....
South Pacific	4	1.30	48	−1.4	....

In Canada.—Professor Stupart says:

The precipitation was largely below the average in all parts of Canada, except in the lower mainland of British Columbia, the Niagara Peninsula, and east and northeast Ontario, where it was generally above the average, and in Western Assiniboia and portions of the Lake Superior region where it was only slightly above the average. The deficiency was from an inch to two and a half inches over the greater portion of British Columbia and Ontario and throughout the Maritime Provinces, nearly an inch below in Quebec, and about half an inch below in the Territories and Manitoba. At the end of the month the whole Dominion, except the Maritime Provinces, was snow covered, the southern portion of Vancouver Island and the lower mainland of British Columbia not excepted, which is unusual; however, the amount was nowhere considerable, except in Ontario and Quebec, and in the former province there was very little snow south and west of the Georgian Bay and Lake Ontario, respectively. This was owing to the fact that the only heavy snowfall of the month did not extend very far west of Lake Ontario or north of Lake Simcoe. Ottawa recorded 30 inches on the ground at the close of the month, Quebec, 25 inches, and Father Point, 35 inches.

SLEET.

The following are the dates on which sleet fell in the respective States:

Alabama, 5, 21, 26, 27, 28, 29, 31. Arizona, 24, 27, 28, 29. Arkansas, 2, 3, 4, 5, 6, 18, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31. Colorado, 3. Connecticut, 2, 10, 19, 21, 26, 27. Delaware, 30, 31. District of Columbia, 29, 30. Florida, 5. Georgia, 18, 20, 21, 27, 28, 29. Idaho, 3. Illinois, 18, 20, 21, 25, 26, 27, 28, 29, 30, 31. Indiana, 18, 24, 25, 26, 27, 28, 29, 30, 31. Indian Territory, 4, 25, 26, 28, 29, 30, 31. Iowa, 4, 20, 25. Kansas, 19, 20, 21, 23, 25, 28. Kentucky, 25, 26, 27, 28, 29, 30, 31. Louisiana, 4, 5, 27, 28, 29. Maine, 27. Maryland, 7, 21, 25, 26, 27, 29, 30, 31. Massachusetts, 2, 3. Michigan, 6, 9, 10, 27. Minnesota, 4, 5. Mississippi, 3, 4, 5, 20, 26, 27, 28, 29, 30, 31. Missouri, 19, 20, 21, 22, 24, 25,

26, 27, 28, 29, 30, 31. Nebraska, 2, 20, 25, 29. Nevada, 2, 16, 21, 23, 24, 25, 27. New Jersey, 3, 8, 11, 18, 19, 21, 22, 29, 30. New Mexico, 12, 27. New York, 10, 18, 21, 22, 23, 26, 27. North Carolina, 11, 16, 20, 21, 27, 28, 29, 30, 31. Ohio, 26, 27, 29, 30. Oklahoma, 4, 24, 25, 26, 27, 28, 29, 31. Oregon, 4, 18, 19, 24, 25, 31. Pennsylvania, 19, 21, 22, 25, 26, 28, 29, 30, 31. South Carolina, 20, 21, 27, 28, 29. Tennessee, 20, 21, 22, 24, 27, 28, 29, 30. Texas, 14, 17, 20, 25, 26, 27, 28, 29, 30. Utah, 2, 16, 17, 19, 28. Vermont, 21. Virginia, 18, 21, 24, 25, 28, 29, 30, 31. Washington, 1, 3, 5, 8, 17, 31. West Virginia, 21, 22, 23, 26, 27, 28, 29, 30, 31. Wisconsin, 5. Wyoming, 2.

HAIL.

The following are the dates on which hail fell in the respective States:

Arizona, 19, 25, 26, 27, 28. California, 29. New Mexico, 11. Oregon, 4, 24, 30, 31. Washington, 8.

HUMIDITY.

The average by districts appear in the subjoined table:

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
	%			%	
New England	74	— 2	Missouri Valley	74	— 4
Middle Atlantic	73	— 2	Northern Slope	76	+ 6
South Atlantic	73	— 5	Middle Slope	68	+ 1
Florida Peninsula	82	0	Southern Slope	56	— 8
East Gulf	73	— 5	Southern Plateau	43	— 8
West Gulf	75	0	Middle Plateau	69	0
Ohio Valley and Tennessee	75	— 2	Northern Plateau	82	+ 1
Lower Lake	78	— 3	North Pacific	86	— 1
Upper Lake	80	— 2	Middle Pacific	75	— 6
North Dakota	78	— 3	South Pacific	66	— 8
Upper Mississippi Valley	76	— 2			

ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table IV, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

Thunderstorms.—Reports of 100 thunderstorms were received during the current month as against 210 in 1901 and 336 during the preceding month.

The dates on which the number of reports of thunderstorms for the whole country were most numerous were: 21st, 14; 26th, 15; 31st, 13.

Reports were most numerous from: Arkansas, 12; Alabama, 9.

Auroras.—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz: 19th to 27th.

In Canada: Auroras were reported at Toronto, 16th; Minnedosa, 17th; Battleford, 4th, 7th.

SUNSHINE AND CLOUDINESS.

The distribution of sunshine is graphically shown on Chart VII, and the numerical values of average daylight cloudiness, both for individual stations and by geographical districts, appear in Table I.

The averages for the various districts, with departures from the normal, are shown in the table below:

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	5.6	— 0.2	Missouri Valley	4.2	— 0.9
Middle Atlantic	6.1	+ 0.5	Northern Slope	4.2	— 0.4
South Atlantic	4.7	— 0.6	Middle Slope	3.9	+ 0.1
Florida Peninsula	4.2	— 0.5	Southern Slope	4.6	+ 0.8
East Gulf	5.5	— 0.1	Southern Plateau	3.5	+ 0.6
West Gulf	5.5	+ 0.1	Middle Plateau	5.0	+ 0.2
Ohio Valley and Tennessee	5.9	— 0.5	Northern Plateau	6.6	— 0.7
Lower Lake	7.2	— 0.3	North Pacific	7.0	— 0.1
Upper Lake	6.6	— 0.2	Middle Pacific	5.4	+ 0.3
North Dakota	3.8	— 0.9	South Pacific	4.7	+ 0.6
Upper Mississippi Valley	4.5	— 0.8			

WIND.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Amarillo, Tex	17	50	w.	Neah Bay, Wash	24	54	e.
Do	20	57	nw.	New York, N. Y	1	74	nw.
Block Island, R. I	1	64	nw.	Do	3	54	nw.
Do	28	53	nw.	Do	21	58	se.
Buffalo, N. Y	2	56	w.	Do	22	63	se.
Do	27	53	w.	Do	28	52	nw.
Cleveland, Ohio	11	54	w.	Point Reyes Light, Cal	21	54	se.
El Paso, Tex	17	55	w.	Do	24	56	nw.
Do	19	50	sw.	Do	25	60	nw.
Havre, Mont	6	50	sw.	Do	28	72	nw.
Mount Tamalpais, Cal	25	55	nw.				

DESCRIPTION OF TABLES AND CHARTS.

By ALFRED J. HENRY, Professor of Meteorology.

For description of tables and charts see page 570 of REVIEW for December, 1901.

TABLE I.—*Climatological data for Weather Bureau Stations, January, 1902.*

Stations.	Elevation of instruments: Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Pressure, in inches: Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Temperature of the air, in degrees Fahrenheit: Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches: Total.	Departure from normal.	Days with .01, or more.	Wind: Total movement, miles.	Prevailing direction.	Maximum velocity: Miles per hour.	Direction.	Date.	Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
New England.							**24.6**	**− 1.0**										**74**	**2.26**	**− 1.8**										**5.6**	
Eastport	76	69	74	29.90	29.90	− .01	21.8	+ 1.4	46	27	30	2	4	14	32	20	15	75	3.41	− 0.5	12	10,842	w.	43	sw.	27	11	7	13	6.0	11.8
Portland, Me.	103	81	117	29.89	30.03	− .02	22.2	− 0.3	46	23	30	4	4	15	25	19	13	71	2.73	− 0.9	8	7,004	nw.	37	nw.	1	11	11	9	5.3	9.5
Northfield	876	15	65	29.07	30.07	+ .02	13.0	− 2.5	44	27	24	−15	20	2	44	11	8	84	2.09	− 1.0	14	5,463	s.	38	nw.	28	8	7	16	6.5	13.0
Boston	125	115	181	29.91	30.06	+ .01	26.6	− 0.4	54	27	34	4	4	20	30	24	19	73	1.65	− 2.4	7	8,921	w.	38	w.	28	12	4	15	5.5	11.0
Nantucket	12	43	85	30.04	30.05	+ .01	29.8	− 1.6	49	22	35	9	4	25	26	27	22	73	2.75	− 1.0	9	11,462	nw.	47	se.	22	6	12	13	6.6	12.7
Block Island	26	11	70	30.04	30.07	.00	29.0	− 2.1	50	27	34	8	1	24	28	27	22	72	1.67	− 2.5	10	14,865	nw.	64	nw.	1	14	7	10	4.8	3.1
Narragansett	.....	10	.....	.....	.....	.....	27.0	− 1.8	50	27	34	4	4	20	27	.....	.....	.....	1.92	− 3.4	11	.....	nw.	.....	.....	.....	17	6	8	.....	5.3
New Haven	106	117	140	29.96	30.08	.00	27.0	− 0.5	49	22	34	6	1	20	25	24	18	70	1.83	− 2.5	13	7,319	nw.	42	e.	22	14	7	10	4.7	5.8
Mid. Atlantic States.							**30.5**	**− 2.0**										**73**	**2.58**	**− 1.0**										**6.1**	
Albany	97	102	115	29.98	30.10	+ .03	22.6	− 0.6	51	22	30	− 2	1	15	30	20	18	84	0.67	− 2.2	11	5,561	nw.	34	se.	2	7	7	17	6.9	2.1
Binghamton	875	79	90	29.10	30.07	− .01	21.6	− 0.8	46	22	29	− 1	20	14	35	.....	.....	.....	1.13	− 1.8	17	5,434	w.	25	nw.	3	3	3	19	7.5	7.1
New York	314	108	350	29.73	30.09	− .01	29.2	− 1.3	49	22	36	12	1	23	24	26	21	70	2.28	− 1.8	13	12,710	nw.	74	nw.	1	11	9	11	5.5	9.4
Harrisburg	374	94	104	29.70	30.13	+ .03	27.6	− 2.7	47	21	34	12	28	22	23	.....	.....	.....	3.28	− 0.4	11	6,358	nw.	33	nw.	3	8	5	18	6.5	8.0
Philadelphia	117	168	184	29.98	30.12	+ .01	31.2	− 0.8	54	21	38	15	4	24	25	27	22	72	2.77	− 0.6	10	8,510	nw.	40	e.	21	9	6	16	6.0	7.7
Scranton	805	111	119	29.20	30.10	+ .01	24.6	.....	48	22	32	5	1	17	34	21	15	68	2.14	.....	10	5,708	sw.	31	ne.	21	4	12	15	7.4	7.3
Atlantic City	52	68	76	30.05	30.11	.00	30.8	− 1.7	50	27	38	14	5	24	22	28	25	79	2.97	− 0.8	13	8,068	nw.	36	nw.	3	8	13	10	5.7	10.3
Cape May	17	47	51	30.11	30.13	+ .01	31.2	− 3.2	48	27	37	16	5	25	21	29	.....	.....	3.11	− 0.7	10	6,888	nw.	32	n.	17	8	13	10	5.9	8.0
Baltimore	123	68	82	29.98	30.11	− .01	31.6	− 2.4	48	27	38	17	29	26	22	28	23	74	3.05	− 0.3	10	3,874	w.	24	e.	21	9	8	14	6.0	6.7
Washington	112	59	76	30.01	30.14	+ .01	31.8	− 1.4	51	21	39	14	5	24	27	27	20	66	3.61	+ 0.1	8	5,797	nw.	35	nw.	3	11	6	14	5.5	7.1
Cape Henry	.....	5	58	.....	.....	.....	36.8	− 3.4	64	27	44	18	6	30	27	.....	.....	.....	2.09	− 2.2	8	11,034	nw.	49	nw.	3	9	11	11	5.8	1.5
Lynchburg	681	83	88	29.36	30.13	.00	34.2	− 2.6	58	10	43	13	5	25	33	29	25	72	3.91	0.0	8	3,539	nw.	34	nw.	22	9	13	9	5.3	4.5
Norfolk	91	102	111	30.03	30.13	.00	37.4	− 3.0	64	10	44	22	4	30	25	33	27	71	2.15	− 1.7	8	6,964	n.	36	se.	21	14	8	9	5.1	1.1
Richmond	144	82	90	29.97	30.14	+ .01	36.2	.....	59	10	44	18	4	28	27	.....	.....	.....	3.26	.....	7	4,117	n.	23	sw.	21	7	9	15	6.3	5.0
S. Atlantic States.							**43.9**	**− 2.7**										**73**	**1.58**	**− 2.7**										**4.7**	
Charlotte	773	68	76	29.29	30.15	.00	38.4	− 2.8	64	10	46	19	5	30	24	33	28	71	2.42	− 2.7	11	5,047	ne.	20	nw.	12	11	8	12	5.9	T.
Hatteras	11	17	42	30.11	.....	.....	42.0	− 3.7	62	27	48	24	4	36	22	39	37	85	1.40	− 4.5	9	11,924	n.	46	n.	17	17	5	9	4.4	
Kittyhawk	8	12	30	.....	.....	.....	40.6	− 1.8	66	27	47	24	13	34	24	.....	.....	.....	3.93	− 1.3	6	11,270	nw.	.....	.....	.....	15	6	10	4.6	
Raleigh	376	93	101	29.74	30.17	+ .04	37.6	− 3.2	67	10	46	17	6	29	28	32	26	67	2.39	− 1.2	9	4,396	sw.	29	nw.	22	11	8	12	5.5	
Wilmington	78	82	90	30.06	30.15	+ .01	43.4	− 3.5	75	27	53	21	5	34	33	37	32	73	1.39	− 2.6	9	6,301	w.	33	se.	21	15	6	10	4.5	
Charleston	48	14	92	30.11	30.16	+ .01	47.2	− 2.8	73	31	56	25	13	38	28	41	36	75	0.45	− 3.5	3	8,027	sw.	35	s.	21	14	10	7	4.3	
Columbia	351	114	122	29.77	30.17	+ .02	43.1	− 2.5	71	27	53	20	6	34	29	36	30	66	1.85	− 2.0	9	6,405	sw.	35	sw.	27	11	8	12	5.5	
Augusta	180	89	103	29.96	30.16	.00	44.2	− 2.4	71	27	55	23	6	34	34	38	32	72	1.60	− 2.9	7	4,627	w.	36	w.	11	14	5	12	5.1	
Savannah	65	79	89	30.09	30.17	+ .02	50.0	− 1.0	78	27	60	26	13	40	30	42	37	70	0.30	− 3.0	2	6,265	w.	34	n.	16	15	13	3	3.5	
Jacksonville	43	69	84	30.12	30.17	+ .02	52.2	− 3.0	77	31	62	27	14	42	31	45	41	77	0.08	− 3.2	3	5,341	ne.	40	sw.	21	15	8	8	4.0	
Florida Peninsula.							**61.7**	**− 3.0**										**82**	**0.47**	**− 2.2**										**4.2**	
Jupiter	28	10	30	30.10	30.13	+ .03	62.8	− 2.9	77	28	70	38	14	55	27	56	54	82	0.98	− 2.5	5	8,716	nw.	33	w.	16	11	16	4	4.5	
Key West	22	43	50	30.10	30.12	+ .02	65.2	− 4.5	78	31	69	50	14	61	14	60	58	82	0.15	− 1.9	2	8,674	ne.	30	nw.	17	10	18	3	4.3	
Tampa	34	60	67	30.12	30.15	+ .03	57.2	− 1.5	80	28	67	30	14	47	31	50	47	81	0.28	− 2.2	2	4,026	n.	30	s.	21	16	11	4	3.7	
East Gulf States.							**48.3**	**− 1.6**										**73**	**2.24**	**− 2.9**										**5.5**	
Atlanta	1,174	190	216	28.90	30.17	+ .02	40.6	− 1.9	65	9	49	18	13	32	28	35	30	71	3.30	− 2.4	9	10,874	nw.	45	nw.	11	12	8	11	5.5	
Macon	370	93	99	29.76	30.16	.00	44.0	.....	68	9	54	23	13	34	34	.....	.....	.....	1.13	.....	10	4,694	nw.	28	nw.	16	10	7	14	5.7	
Pensacola	56	78	96	30.11	30.18	+ .04	51.6	− 0.9	70	30	60	28	13	44	22	.....	.....	.....	0.63	− 4.0	6	7,337	ne.	40	nw.	21	12	9	10	4.8	
Mobile	57	88	96	30.12	30.18	+ .03	49.9	− 0.6	69	24	59	27	13	41	29	45	40	77	2.79	− 2.3	9	5,578	n.	32	n.	27	13	3	15	5.2	
Montgomery	223	100	112	29.94	30.18	+ .02	46.2	− 2.1	68	26	56	23	13	36	33	41	36	71	3.73	− 1.6	8	5,096	n.	31	w.	21	10	9	12	5.4	
Meridian	375	84	93	29.79	30.20	+ .04	44.4	− 2.6	71	26	56	20	14	33	42	.....	.....	.....	2.93	− 2.7	11	4,421	n.	29	w.	21	10	8	13	5.8	0.3
Vicksburg	247	62	74	29.90	30.18	+ .03	45.2	− 2.1	74	26	53	26	28	37	31	39	33	69	2.32	− 3.2	13	5,086	ne.	30	nw.	21	9	7	15	5.9	0.2
New Orleans	51	88	121	30.11	30.17	+ .04	53.4	− 0.4	77	29	62	33	13	45	27	48	44	77	0.97	− 4.2	6	6,515	ne.	29	nw.	21	10	15	6	5.5	
Port Eads	.....	27	.....	.....	.....	.....	55.0	− 1.7	79	30	64	36	22	46	26	.....	.....	.....	1.29	− 3.1	8	.....	ne.	.....	.....	.....	8	11	12	.....	.....
West Gulf States.							**46.4**	**− 0.2**										**75**	**2.35**	**− 1.1**										**5.5**	
Shreveport	249	77	84	29.92	30.20	+ .06	44.2	− 1.7	70	8	54	23	27	35	39	40	35	76	1.34	− 3.3	10	5,351	se.	36	w.	20	9	9	13	5.9	T.
Fort Smith	457	79	94	29.69	30.19	+ .05	37.7	+ 1.6	71	9	47	10	27	28	37	32	26	70	2.65	+ 0.3	10	6,374	e.	41	nw.	21	12	10	9	4.9	6.1
Little Rock	357	93	100	29.81	30.20	+ .05	39.2	− 1.6	69	9	47	16	27	31	31	34	28	69	7.13	+ 2.3	13	5,873	nw.	33	nw.	26	10	7	14	5.6	1.7
Corpus Christi	20	48	53	30.13	30.15	+ .05	54.8	− 0.7	79	20	61	28	27	48	46	51	48	83	2.14	− 0.7	7	6,856	n.	34	n.	26	9	14	8	5.0	
Fort Worth	670	106	114	29.47	30.20	+ .08	44.0	.....	74	8	55	13	27	33	45	.....	.....	.....	0.42	.....	7	8,114	sw.	48	nw.	20	12	12	7	5.0	3.8
Galveston	54	106	112	30.09	30.14	+ .01	51.7	− 1.0	70	20	57	32	27	47	27	49	46	86	0.92	− 2.8	10	9,018	se.	37	nw.	26	11	9	11	5.6	
Palestine	510	73	79	29.64	30.18	+ .06	45.9	+ 2.1	71	8	55	18	27	37	46	40	36	74	1.56	− 2.8	8	5,147	n.	36	w.	20	12	4	15	5.9	2.7
San Antonio	701	80	91	29.41	30.15	+ .05	51.4	− 0.1	74	20	62	26	27	41	33	45	39	67	0.70	− 1.0	8	5,699	se.	33	n.	27	11	5	15	5.8	T.
Taylor	583	55	63	29.55	30.17	+ .06	47.0	.....	75	10	58	18	27	36	44	.....	.....	.....	0.51	.....	8	6,773	n.	33	n.	27	12	2	17	5.6	0.6
Ohio Val. and Tenn.							**33.6**	**− 0.7**										**75**	**3.24**	**− 1.0**										**5.9**	
Chattanooga	762	106	112	29.36	30.20	+ .04	39.5	− 1.5	68	9	48	19	14	31	30	34	28	67	3.48	− 2.7	10	6,244	sw.	34	nw.	22	12	8	11	5.1	T.
Knoxville	1,004	10	88	29.08	30.16	− .01	36.9	− 0.8	62	9	45	16	14	28	31	32	29	78	3.71	− 1.8	11	5,826	sw.	31	nw.	27	8	9	14	6.2	0.5
Memphis	397	140	154	29.78	30.21	+ .05	39.8	− 0.1	68	9	47	15	27	32	35	34	28	68	6.00	+ 0.5	11	7,915	nw.	36	nw.	21	10	9	12	5.3	1.0
Nashville	546	122	131	29.60	30.20	+ .04	37.5	− 0.7	69	9	46	16	28	29	32	33	28	73	4.68	− 0.4	12	5,685	nw.	34	s.	20	11	9	11	5.4	1.4
Lexington	989	75	102	29.07	30.16	+ .03	32.3	− 1.0	60	9	40	8	28	25	28	.....	.....	.....	4.77	+ 1.0	9	8,435	nw.	31	nw.	21	9	11	11	5.7	1.5
Louisville	525	114	136	29.59	30.20	+ .06	33.6	− 0.5	62	9	41	9	28	26	27	30	25	74	4.67	+ 0.6	6	6,605	s.	28	w.	11	14	5	12	5.4	1.2
Evansville	431	72	82	29.71	30.20	+ .06	32.7	.....	61	8	40	6	27	25	33	.....	.....	.....	2.36	.....	7	5,301	ne.	26	s.	14	17	4	10	4.2	T.
Indianapolis	822	154	164	29.25	30.18	+ .06	28.3	0.0	56	9	35	1	27	21	27	25	21	76	0.76	− 2.2	5	8,049	nw.	37	nw.	10	10	12	9	5.3	5.2
Cincinnati	628	152	157	29.47	30.18	+ .06	31.5	− 1.0	59	9	39	6	28	24	28	28	23	73	2.10	− 1.4	7	6,348	nw.	29	nw.	11	10	6	15	6.2	6.3
Columbus	824	87	100	29.23	30.14	+ .03	28.8	+ 0.4	55	9	36	4	28	22	28	25	21	76	1.56	− 1.8	8	6,622	nw.	27	nw.	22	9	4	18	6.6	8.6
Pittsburg	842	116	123	29.18	30.11	.00	30.4	− 0.2	52	2	37	8	28	24	35	27	23	76	1.49	− 1.7	11	4,987	nw.	27	nw.	11	5	10	16	7.3	10.7
Parkersburg	638	77	84	29.47	30.17	+ .05	30.6	− 2.4	55	9	38	10	28	23	30	28	25	85	2.42	− 0.7	10	5,260	s.	30	nw.	11	8	6	17	6.6	10.0
Elkins	1,940	41	50	28.00	30.12	.00	28.4	.....	54	9	38	1	5	19	38	24	21	81	3.90	.....	16	3,823	w.	22	w.	3	4	14	13	7.0	14.8
Lower Lake Region.							**24.9**	**− 0.4**										**78**	**1.75**	**− 0.9**										**7.2**	
Buffalo	767	178	206	29.20	30.05	− .02	24.8	+ 0.4	44	26	31	3	28	19	32	23	19	77	4.01	+ 1.0	21	12,183	w.	56	w.	2	0	10	21	8.5	39.5
Oswego	335	76	91	29.68	30.07	.00	22.4	− 1.9	41	27	29	1	17	16	29	21	18	83	2.49	− 0.5	20	9,579	se.	42	nw.	27	1	4	26	8.8	16.0
Rochester	523	81	90	29.48	30.07	.00	23.5	− 0.4	42	2	30	2	28	17	35	21	18	79	2.50	− 0.6	13	7,667	sw.	36	w.	2	3	13	15	6.9	23.8
Erie	713	92	102	29.29	30.09	+ .01	25.4	− 1.5	46	26	31	4	28	20	29	24	21	82	1.86	− 1.5	10	9,597	sw.	37	nw.	11	2	6	23	7.9	17.5
Cleveland	762	190	201	29.26	30.10	+ .01	26.2	0.0	47	9	32	4	28	21	27	23	18	70	1.25	− 1.3	13	13,559	w.	54	w.	11	6	10	15	7.0	12.9
Sandusky	629	62	70	29.42	30.13	+ .04	26.8	+ 0.3	47	2	33	2	28	21	25	.....	.....	.....	0.60	− 1.6	10	7,547	sw.	36	nw.	11	7	7	17	6.8	6.1
Toledo	628	123	127	29.42	30.13	+ .04	25.6	− 0.5	44	2	32	1	28	19	24	23	19	76	0.72	− 1.4	5	8,315	w.	36	w.	11	12	10	9	5.3	6.7
Detroit	730	153	190	29.29	30.11	+ .03	24.6	+ 0.1	40	2	30	0	28	19	21	23	19	80	0.57	− 1.4	6	9,445	w.	36	w.	27	7	13	11	6.2	5.4
Upper Lake Region.							**20.9**	**+ 3.3**										**80**	**0.75**	**− 1.3**										**6.6**	
Alpena	609	63	80	29.38	30.08	+ .04	20.5	+ 2.4	37	2	28	− 8	28	13	28	19	17	88	0.77	− 1.7	12	8,340	w.	37	nw.	2	4	7	20	7.6	10.4
Escanaba	612	43	57	29.40	30.10	+ .05	18.6	+ 4.6	37	9	26	−18	28	11	31	17	15	88	0.56	− 1.0	9	6,669	sw.	29	nw.	11	5	5	21	7.2	6.2
Grand Haven	632	54	92	29.40	30.12	+ .05	24.8	+ 0.6	41	8	30	0	28	19	23	23	20	82	0.53	− 2.1	11	10,205	nw.	45	w.	2	4	8	19	7.6	6.7
Houghton	668	66	74	29.32	30.08	+ .03	17.2	.....	39	9	26	−10	27	9	42	.....	.....	.....	1.90	.....	19	5,124	e.	34	nw.	27	6	7	18	7.4	24.2
Marquette	734	79	116	29.25	30.08	+ .04	19.9	+ 3.9	37	7	26	−14	28	14	32	18	14	76	1.75	− 0.3	16	9,881	nw.	43	sw.	17	5	4	22	7.5	22.7
Port Huron	638	70	120	29.40	30.13	+ .07	22.6	+ 0.8	39	8	29	− 3	28	16	25	21	18	82	0.52	− 1.6	9	10,212	nw.	41	nw.	3	4	14	13	6.4	5.0
Sault Ste. Marie	614	40	61	29.34	30.04	+ .01	17.1	+ 2.8	36	8	25	− 9	19	9	32	16	13	83	0.98	− 0.8	17	6,548	se.	47	nw.	2	6	4	21	7.6	9.8
Chicago	823	241	274	29.24	30.18	+ .08	25.2	+ 1.8	50	9	31	− 8	27	19	35	23	19	77	0.66	− 1.5	8	12,736	w.	48	s.	17	10	14	7	5.0	6.2
Milwaukee	681	124	142	29.38	30.16	+ .08	23.7	+ 4.3	47	9	31	−10	28	17	32	21	18	79	0.51	− 1.7	4	8,030	w.	34	se.	26	11	7	13	5.6	5.5
Green Bay	617	49	57	29.44	30.14	+ .08	19.4	+ 5.2	40	9	27	−18	28	11	33	17	12	73	0.45	− 2.0	7	5,908	sw.	32	nw.	2	7	12	12	6.4	7.5
Duluth	702	95	116	29.32	30.12	+ .03	16.8	+ 6.4	43	7	25	−22	27	8	31	14	10	77	0.74	− 0.3	10	7,306	sw.	44	nw.	12	15	7	9	4.8	8.5
North Dakota.							**13.4**	**+10.9**										**78**	**0.23**	**− 0.4**										**3.8**	
Moorhead	935	54	60	29.12	30.20	+ .06	12.2	+13.1	43	8	22	−26	27	3	32	11	10	90	0.56	− 0.2	8	7,337	nw.	32	nw.	1	17	7	7	4.0	5.6
Bismarck	1,674	16	29	28.34	30.22	+ .09	14.2	+ 9.7	46	8	24	−29	28	4	30	10	3	63	0.05	− 0.5	2	5,534	nw.	41	nw.	1	23	3	5	3.7	0.5
Williston	1,875	15	31	28.10	30.19	+ .08	13.8	+ 9.9	47	7	23	−24	28	5	31	12	9	82	0.09	− 0.5	3	5,362	nw.	36	nw.	1	23	7	1	3.6	0.9

TABLE I.—*Climatological data for Weather Bureau Stations, January, 1902*—Continued.

Stations.	Elevation of instruments: Barometer above sea level, feet.	Elevation of instruments: Thermometers above ground.	Elevation of instruments: Anemometer above ground.	Pressure, in inches: Actual, reduced to mean of 24 hours.	Pressure, in inches: Sea level, reduced to mean of 24 hrs.	Pressure, in inches: Departure from normal.	Temperature: Mean max. + mean min. ÷ 2.	Temperature: Departure from normal.	Temperature: Maximum.	Temperature: Date.	Temperature: Mean maximum.	Temperature: Minimum.	Temperature: Date.	Temperature: Mean minimum.	Temperature: Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation: Total.	Precipitation: Departure from normal.	Precipitation: Days with .01, or more.	Wind: Total movement, miles.	Wind: Prevailing direction.	Wind: Maximum velocity: Miles per hour.	Wind: Maximum velocity: Direction.	Wind: Maximum velocity: Date.	Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
Upper Miss. Valley.							**25.4**	**+ 4.3**										**76**	**0.97**	**− 0.8**										**4.5**	
Minneapolis	......	99	208	......	......	......	18.7	+ 6.8	46	8	27	−17	27	10	34	....	....	....	0.44	− 0.4	8	9,104	nw.	44	nw.	10	8	16	7	....	5.3
St. Paul	837	114	124	29.22	30.17	+ .06	18.5	+ 7.9	43	8	26	−18	28	11	31	16	12	79	0.53	− 0.4	7	6,246	nw.	36	nw.	10	14	12	5	4.3	5.3
La Crosse	714	70	86	29.38	30.18	+ .07	20.4	+ 5.7	47	8	28	−24	28	12	30	....	....	....	0.63	− 0.6	7	5,322	s.	26	nw.	10	10	13	8	4.7	11.8
Davenport	606	71	79	29.50	30.18	+ .06	24.0	+ 4.0	52	9	32	−13	27	16	36	21	17	79	0.60	− 1.1	6	5,490	w.	27	nw.	10	15	8	8	4.5	7.3
Des Moines	861	84	88	29.26	30.24	+ .10	24.4	+ 6.9	58	8	34	−16	27	15	30	21	18	81	0.91	− 0.4	6	5,506	nw.	26	n.	2	9	14	8	5.1	12.0
Dubuque	698	100	117	29.41	30.18	+ .06	22.8	+ 5.5	52	9	31	−18	28	15	29	19	16	80	0.74	− 0.9	7	5,005	nw.	26	nw.	10	15	11	5	3.9	8.3
Keokuk	614	63	78	29.50	30.20	+ .06	27.5	+ 4.3	57	*	36	−10	27	20	29	23	19	78	0.44	− 1.3	6	5,644	nw.	20	nw.	26	17	6	8	3.7	5.5
Cairo	356	87	93	29.82	30.21	+ .05	34.8	+ 0.1	67	9	42	7	27	27	31	30	25	73	3.42	− 0.4	7	6,922	sw.	38	n.	26	6	15	10	5.9	0.1
Springfield, Ill	644	82	93	29.48	30.20	+ .07	27.8	+ 2.3	57	9	35	− 8	27	21	30	24	18	69	1.01	− 1.0	7	7,123	nw.	29	se.	25	12	10	9	5.0	11.7
Hannibal	534	75	110	29.62	30.22	+ .09	28.2	+ 2.3	60	9	37	− 8	27	20	35	....	....	....	0.78	− 0.8	7	6,691	sw.	26	s.	17	15	9	7	4.4	7.9
St. Louis	567	111	210	29.57	30.20	+ .06	32.4	+ 1.9	63	9	39	0	27	26	30	28	22	67	1.18	− 1.0	7	7,711	nw.	31	w.	8	19	4	8	3.8	6.6
Missouri Valley.							**26.4**	**+ 5.9**										**74**	**0.81**	**− 0.2**										**4.2**	
Columbia	784	11	84	29.34	30.21	+ .08	29.2	− 1.4	63	9	38	− 9	27	20	39	....	....	....	1.04	− 0.8	4	6,234	nw.	30	nw.	26	10	12	9	5.3	9.9
Kansas City	963	78	95	29.17	30.24	+ .09	30.8	+ 5.4	64	9	39	− 7	27	22	39	26	20	68	0.77	− 0.4	6	5,832	nw.	28	nw.	26	16	9	6	3.9	8.3
Springfield, Mo	1,324	98	104	28.75	30.20	+ .06	32.4	+ 0.1	66	9	40	− 1	27	25	33	29	26	81	1.12	− 1.3	8	7,945	nw.	39	se.	25	15	6	10	4.6	2.2
Topeka	......	81	....	......	......	......	30.3	+ 3.5	67	9	40	−10	27	20	38	....	....	....	1.56	+ 0.5	7	5,798	nw.	29	nw.	21	10	13	8	4.7	12.4
Lincoln	1,189	75	84	28.88	30.21	+ .06	26.4	+ 8.7	60	7	36	−11	27	17	34	21	16	73	1.02	+ 0.2	5	7,005	s.	33	nw.	25	17	9	5	3.7	11.3
Omaha	1,105	115	121	28.97	30.21	+ .06	26.6	+ 7.4	59	8	35	−12	27	18	29	23	19	80	0.71	0.0	3	5,820	nw.	35	n.	2	16	9	6	4.4	8.0
Valentine	2,598	39	40	27.36	30.19	+ .07	23.6	+ 6.7	64	8	36	−26	27	11	40	19	14	74	0.34	− 0.3	2	6,357	w.	32	nw.	17	17	9	5	3.3	5.0
Sioux City	1,135	96	164	28.95	30.23	+ .08	22.8	+ 6.5	51	8	31	−21	27	14	29	....	....	....	0.83	0.0	5	8,095	nw.	38	nw.	2	19	7	5	3.4	13.9
Pierre	1,572	43	50	28.48	30.22	+ .09	23.2	+10.5	60	8	33	−16	*	13	38	18	12	67	0.37	− 0.1	5	4,555	n.	31	n.	1	16	7	8	4.0	3.7
Huron	1,306	56	67	28.76	30.22	+ .06	18.9	+11.9	55	8	29	−20	27	8	32	15	11	75	0.32	− 0.2	5	7,989	nw.	37	s.	16	12	14	5	4.6	3.1
Yankton	1,233	42	49	......	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Northern Slope.							**23.3**	**+ 5.8**										**76**	**0.20**	**− 0.5**										**4.2**	
Havre	2,505	46	53	27.43	30.18	+ .08	22.2	+12.5	59	7	32	−26	25	12	41	19	15	79	0.24	− 0.6	8	8,672	sw.	50	sw.	6	14	11	6	4.7	2.5
Miles City	2,371	42	50	27.59	30.22	+ .10	22.6	+12.0	54	6	32	−22	26	13	30	19	17	91	0.05	− 0.5	2	3,930	s.	30	nw.	4	22	8	1	2.6	0.5
Helena	4,110	88	93	25.88	30.26	+ .11	22.6	+ 5.5	63	7	30	−24	25	15	29	19	14	72	0.14	− 1.2	7	4,613	sw.	38	sw.	6	11	10	10	5.1	1.4
Kalispell	2,965	45	51	27.06	30.25	+ .13	22.0	......	55	7	28	−18	27	16	24	20	18	84	0.77	......	12	3,164	w.	23	sw.	8	7	7	17	6.4	6.6
Rapid City	3,234	46	50	26.68	30.20	+ .10	25.3	+ 5.1	65	7	37	−22	26	14	39	20	15	71	0.18	− 0.2	5	5,508	w.	34	nw.	14	16	9	6	3.5	1.8
Cheyenne	6,088	56	64	23.99	30.19	+ .14	25.5	+ 0.5	59	12	37	−27	26	14	37	19	12	62	0.21	− 0.2	4	6,916	nw.	42	nw.	6	16	13	2	3.7	2.1
Lander	5,372	26	36	24.68	30.29	+ .17	18.9	− 1.0	51	8	31	−30	26	6	37	14	11	78	0.18	− 0.6	4	1,704	sw.	15	se.	6	15	11	5	3.7	1.8
North Platte	2,821	43	52	27.19	30.24	+ .12	26.2	+ 6.2	60	1	38	−19	26	14	41	20	14	70	0.40	− 0.1	2	5,480	w.	35	nw.	20	18	10	3	3.7	5.5
Middle Slope.							**30.8**	**+ 1.8**										**68**	**0.36**	**− 0.5**										**3.9**	
Denver	5,291	79	151	24.75	30.18	+ .13	29.0	+ 0.8	66	8	43	−20	26	15	45	22	14	62	0.17	− 0.4	4	5,176	sw.	34	n.	3	21	7	3	2.8	2.8
Pueblo	4,685	80	86	25.31	30.16	+ .11	28.8	+ 0.1	70	13	45	−10	27	13	51	22	14	59	0.14	− 0.3	3	4,071	nw.	34	w.	20	15	12	4	4.2	1.7
Concordia	1,398	42	47	28.69	30.22	+ .08	28.6	+ 5.4	67	8	39	−14	27	18	38	23	20	79	0.77	0.0	6	4,742	s.	28	s.	19	17	6	8	3.9	7.2
Dodge	2,509	44	52	27.50	30.20	+ .09	30.8	+ 4.2	74	9	44	−10	30	17	58	24	19	72	0.34	− 0.1	5	7,147	nw.	48	nw.	25	16	9	6	4.5	4.5
Wichita	1,358	78	85	28.74	30.22	+ .09	31.8	+ 1.2	69	9	41	− 6	26	22	33	26	20	68	0.32	− 0.7	6	6,221	n.	30	n.	26	18	5	8	3.7	4.7
Oklahoma	1,214	54	62	28.86	30.19	+ .08	35.8	− 1.2	70	9	46	0	26	25	34	30	23	66	0.44	− 1.5	5	7,602	s.	36	nw.	20	15	10	6	4.4	1.3
Southern Slope.							**39.6**	**+ 2.2**										**56**	**0.06**	**− 0.6**										**4.6**	
Abilene	1,738	45	54	28.32	30.16	+ .07	43.8	+ 1.0	70	8	55	10	27	33	42	36	28	59	0.09	− 0.8	2	6,676	se.	48	nw.	20	11	15	5	5.1	0.4
Amarillo	3,676	54	61	26.30	30.13	+ .07	35.4	+ 3.5	70	9	47	− 4	26	23	50	28	16	52	0.04	− 0.5	3	11,247	sw.	57	nw.	20	12	16	3	4.0	0.3
Southern Plateau.							**42.6**	**+ 2.0**										**43**	**0.85**	**− 0.4**										**3.5**	
El Paso	3,762	10	110	26.21	30.03	+ .02	46.8	+ 2.3	76	19	61	24	30	32	42	35	22	45	0.57	0.0	1	7,888	nw.	55	w.	17	19	10	2	2.7	
Santa Fe	7,013	47	50	23.23	30.09	+ .05	33.8	+ 5.9	54	3	44	9	27	24	27	26	18	58	0.28	− 0.3	7	4,416	se.	38	s.	19	17	12	2	3.5	4.3
Flagstaff	6,907	12	25	23.32	30.05	.00	27.8	− 1.0	60	2	43	−12	26	13	46	24	....	....	3.17	− 0.5	10	......	e.	....	....	...	8	13	10	5.2	32.9
Phoenix	1,108	47	57	28.86	30.03	.00	52.5	+ 3.1	81	4	67	30	20	38	39	41	27	43	0.79	0.0	5	2,580	e.	24	sw.	19	16	5	10	4.1	
Yuma	141	16	50	29.87	30.02	− .03	55.2	+ 1.0	80	4	68	31	31	42	38	42	26	36	0.26	− 0.2	2	4,760	n.	32	w.	24	24	3	4	2.0	
Independence	3,910	51	58	26.04	30.08	− .01	39.4	+ 1.0	65	12	51	10	26	28	36	31	14	34	0.04	− 1.2	1	5,575	nw.	48	w.	25	12	18	1	3.5	T.
Middle Plateau.							**29.1**	**+ 0.8**										**69**	**0.41**	**− 1.0**										**5.0**	
Carson City	4,720	82	92	25.33	30.17	+ .04	31.2	− 1.1	63	7	44	− 2	26	19	39	27	23	75	0.33	− 2.2	4	3,307	e.	38	sw.	16	15	11	5	4.0	2.6
Winnemucca	4,344	59	70	25.69	30.20	+ .04	27.8	+ 0.8	56	2	40	−15	26	16	40	24	19	72	0.13	− 1.0	5	6,237	ne.	46	nw.	25	10	8	13	5.9	1.3
Modena	5,479	10	38	24.64	30.13	+ .03	27.1	......	60	8	41	−18	30	13	47	21	12	57	0.33	......	6	5,311	w.	32	w.	16	10	11	10	4.9	3.4
Salt Lake City	4,366	105	110	25.70	30.21	+ .06	27.5	− 0.4	43	1	33	− 4	26	22	24	25	23	83	0.80	− 0.6	5	2,844	se.	39	w.	25	10	6	15	5.8	6.4
Grand Junction	4,608	43	51	25.44	30.18	+ .12	30.0	+ 4.1	53	10	43	− 2	27	17	37	23	15	59	0.37	− 0.2	6	3,133	se.	26	sw.	25	15	4	12	4.6	3.2
Northern Plateau.							**27.6**	**+ 2.7**										**82**	**0.96**	**− 1.2**										**6.6**	
Baker City	3,471	53	58	26.55	30.25	+ .09	26.2	+ 3.4	49	8	34	− 8	26	19	24	23	19	78	0.56	− 1.1	8	4,243	se.	30	nw.	25	10	4	17	6.1	5.0
Boise	2,739	61	68	27.33	30.30	+ .11	28.5	+ 1.1	59	7	37	− 8	26	20	32	26	23	83	0.63	− 1.7	9	2,196	se.	23	sw.	25	7	9	15	6.6	7.9
Lewiston	757	52	61	29.41	30.24	+ .08	32.8	......	58	4	39	1	25	26	20	....	....	....	0.83	......	9	2,550	e.	32	nw.	7	7	4	20	7.1	4.8
Pocatello	4,482	46	54	25.57	30.27	+ .07	24.5	+ 5.4	54	8	34	−19	28	15	29	21	18	80	0.86	− 1.2	6	5,157	se.	30	se.	6	11	7	13	5.7	8.6
Spokane	1,943	99	107	28.14	30.28	+ .16	27.8	+ 3.3	54	5	34	−12	27	22	27	26	23	80	1.29	− 1.2	11	3,741	ne.	30	sw.	7	6	7	18	7.1	6.1
Walla Walla	1,000	65	73	29.16	30.27	+ .12	31.0	+ 0.5	67	7	36	− 2	25	26	24	29	28	91	1.44	− 1.0	12	3,299	s.	27	w.	7	5	6	20	6.8	8.4
N. Pac. Coast Reg.							**39.5**	**+ 0.6**										**86**	**5.53**	**− 2.7**										**7.0**	
Neah Bay	30	7	50	30.06	30.09	+ .11	40.8	+ 0.1	57	3	44	20	25	37	12	40	38	87	9.13	− 6.2	18	8,000	e.	54	e.	24	8	6	17	6.7	5.6
Port Crescent	259	13	20	29.85	30.10	+ .11	37.4	+ 1.9	58	5	43	12	25	32	18	....	....	....	5.57	− 1.5	14	2,351	e.	36	sw.	5	2	13	16	7.4	14.0
Seattle	123	114	151	30.04	30.17	+ .12	39.8	+ 0.8	58	7	44	13	25	35	18	38	35	84	5.25	+ 0.7	20	5,064	se.	40	nw.	24	6	8	17	7.7	13.8
Tacoma	213	113	120	29.93	30.16	+ .12	38.4	+ 0.4	57	6	44	15	25	33	20	....	....	....	6.21	− 0.2	20	3,839	s.	40	n.	24	4	5	22	7.8	13.8
Astoria	20	57	64	......	......	......	40.8	+ 0.3	56	*	46	19	25	35	21	....	....	....	7.23	− 3.4	17	......	ne.	....	....	....	7	6	18	6.6	0.7
Portland, Oreg	154	203	213	30.02	30.19	+ .11	38.4	0.0	61	7	44	13	25	33	19	36	34	84	3.11	− 4.0	18	6,087	e.	43	s.	7	4	8	19	7.3	6.8
Roseburg	518	56	67	29.60	30.17	+ .07	40.8	+ 0.5	63	6	46	19	25	36	25	39	37	87	2.24	− 4.0	19	1,993	nw.	22	nw.	25	7	12	12	6.0	3.7
Mid. Pac. Coast Reg.							**45.9**	**− 1.2**										**75**	**1.53**	**− 3.9**										**5.4**	
Eureka	62	62	80	30.12	30.19	+ .09	46.6	+ 0.3	67	1	52	29	27	41	23	44	40	80	1.95	− 6.5	14	4,749	se.	43	n.	25	6	13	12	5.9	
Mount Tamalpais	2,375	11	18	27.63	30.13	+ .02	45.0	......	64	6	50	26	29	40	18	38	26	56	2.02	......	10	13,105	nw.	55	nw.	25	11	13	7	4.6	
Red Bluff	332	50	56	29.81	30.17	+ .05	44.0	− 0.9	70	10	52	28	31	36	37	40	35	77	1.99	− 2.7	7	3,565	n.	30	n.	25	7	11	13	6.1	
Sacramento	69	106	117	30.08	30.15	+ .03	43.3	− 2.3	59	2	49	29	27	38	23	41	36	82	0.95	− 2.9	7	4,803	se.	40	nw.	25	5	7	19	6.8	
San Francisco	155	161	167	30.00	30.17	+ .06	46.7	− 3.4	58	3	52	38	14	42	16	44	41	81	1.23	− 3.5	9	5,632	n.	32	se.	23	13	13	5	4.5	
Point Reyes Light	......	10	30	......	......	......	49.0	+ 0.4	61	*	55	36	29	43	20	....	....	....	1.87	− 4.2	12	9,555	nw.	72	nw.	28	14	8	9	4.8	
S. Pac. Coast Reg.							**52.1**	**+ 1.6**										**66**	**1.30**	**− 1.4**										**4.7**	
Fresno	330	67	70	29.79	30.17	+ .07	43.2	− 1.3	63	1	50	24	29	36	25	41	38	83	0.41	− 0.9	4	3,084	nw.	24	nw.	25	4	4	23	7.7	
Los Angeles	338	74	82	29.69	30.06	− .02	55.8	+ 2.7	87	3	68	32	26	44	34	47	38	58	1.62	− 1.3	4	2,938	ne.	15	sw.	19	12	16	3	4.0	T.
San Diego	87	94	102	29.95	30.05	− .02	56.4	+ 2.8	81	4	64	36	30	49	27	48	41	64	1.70	− 0.3	8	4,207	nw.	33	s.	24	20	4	7	3.5	
San Luis Obispo	201	10	46	29.91	30.14	+ .05	53.1	+ 2.0	83	6	66	26	27	41	41	44	36	60	1.46	− 3.2	4	3,771	n.	26	n.	4	17	9	5	3.7	
West Indies.																															
Basseterre	29	41	54	29.96	29.98	− .02	77.0	......	83	11	82	67	7	72	15	72	70	80	1.64	......	14	6,672	e.	23	ne.	29	11	14	6	4.8	
Bridgetown	30	57	65	29.92	29.95	.00	78.0	+ 3.2	85	7	84	69	20	72	15	72	69	75	0.67	− 2.0	17	6,047	e.	24	ne.	30	15	12	4	3.9	
Cienfuegos	52	62	67	30.02	30.07	+ .04	67.8	......	84	28	77	51	23	59	24	61	59	82	0.20	......	2	5,761	ne.	27	w.	16	23	6	2	2.6	
Grand Turk	11	6	20	30.06	30.07	+ .04	72.3	......	85	4	80	56	25	65	24	....	....	....	3.70	......	17	......	e.	....	......	...	1	9	21	7.1	
Havana	57	87	105	30.05	30.11	+ .06	67.0	− 3.3	82	31	74	51	18	61	22	63	61	85	7.49	+ 4.8	7	9,314	e.	36	ne.	28	12	12	7	4.9	
Kingston	286	38	52	......	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Port of Spain	40	65	66	29.87	29.91	+ .01	77.8	......	87	4	85	69	16	71	17	71	69	76	2.96	......	18	2,775	e.	20	e.	1	4	19	5	5.9	
Puerto Principe	352	55	62	29.71	30.07	+ .05	68.1	......	85	30	77	50	14	59	28	62	61	87	1.82	......	7	6,054	ne.	26	e.	27	15	9	7	4.5	
Roseau	25	37	47	29.93	29.96	......	77.3	......	86	4	84	69	7	71	16	70	66	71	1.51	......	14	3,766	e.	23	e.	27	11	15	5	4.7	
San Juan	82	48	90	29.92	30.02	.00	75.4	......	86	17	80	67	25	70	14	71	69	82	12.45	+ 9.5	22	8,677	e.	31	ne.	29	4	13	14	6.6	
Santiago de Cuba	82	46	52	29.92	30.01	+ .01	73.3	......	85	4	81	57	14	66	19	66	63	79	1.77	......	3	6,298	n.	24	ne.	1	13	10	8	4.7	
Santo Domingo	57	37	44	29.96	30.02	+ .02	74.3	......	85	26	81	62	22	68	19	69	68	87	1.12	......	12	5,193	n.	24	n.	14	11	14	6	5.0	
Willemstad	75	39	46	29.81	29.89	− .01	79.0	......	85	22	83	70	28	75	13	73	71	78	1.09	......	13	8,098	e.	26	e.	28	2	21	8	5.8	

NOTE.—The data at stations having no departures are not used in computing the district averages. * More than one date.

TABLE II.—*Climatological record of voluntary and other cooperating observers, January, 1902.*

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	Ins.	Ins.
Alabama.					
Ashville	67	12	40.6	4.34	
Benton				4.08	
Bermuda	73[b]	19[d]	49.2[e]	3.05	
Birmingham	72	17	44.0	3.79	
Bridgeport				4.44	
Burkville				4.22	
Calera				4.58	
Camphill	70	15	43.0	2.90	
Citronelle	71	27	51.0	2.13	
Clanton	67	19	43.3	7.60	
Cordova				4.02	
Daphne	76[e]	24[e]	50.0[e]	1.95	
Decatur	69	18	42.2	4.23	
Demopolis				3.87	
Eufaula *a*	72	18	45.5	1.32	
Eutaw	70	19	42.7	4.13	
Evergreen	70	20	48.5	3.48	
Flomaton	72	20	49.5	3.11	
Florence *a*				6.01	0.5
Florence *b*	70	13	40.3	5.80	1.3
Fort Deposit	69	20	44.8	2.16	
Gadsden	72	16	41.8	4.03	
Goodwater	69	15	42.3	3.92	
Greensboro	64	21	43.6	4.61	
Greenville				4.30	
Hamilton	66	12	39.4	4.74	
Healing Springs	76	19	47.5	4.42	
Highland Home	69	20	47.8	2.63	
Letohatchee				2.90	
Livingston *a*	68	19	41.2	2.36	
Lock No. 4	68	16	40.4	3.56	
Madison Station	69	15	39.8	3.22	
Maplegrove	70	14	38.6	5.58	
Marion	70	19	44.1	3.70	
Mount Willing	70	22	47.1	4.05	
Newbern	65	19	43.9	4.38	
Notasulga				3.71	
Oneonta	67	10	39.7	4.68	T.
Opelika	70	19	43.4	4.37	
Oxanna	73	15	43.0	4.13	
Prattville	71	16	45.9		
Pushmataha	73	19	45.0	5.65	6.0
Riverton	71	11	38.0	5.52	
Scottsboro	64	14	38.2	5.40	T.
Selma	70	21	44.2	3.51	
Talladega	68	20	42.4	4.76	
Tallassee				2.11	
Thomasville	70	22	48.0		
Tuscaloosa	68	18	40.9	3.54	
Tuscumbia	64	18	37.3	6.00	
Tuskegee	71	19	46.1	3.04	
Union Springs	70	20	46.3	4.10	
Uniontown	70	18	45.0	4.22	
Valleyhead	63	14	39.1	4.23	
Verbena				3.25	
Wetumpka	69	18	45.6	2.36	
Alaska.					
Juneau	43	12	33.1	12.76	21.0
Killisnoo	43	13	32.5	6.95	26.0
Sitka	49	16	36.2	11.92	5.5
Arizona.					
Agua Caliente	78	28	51.6	0.45	
Allaire Ranch				0.36	0.8
Arizona Canal Co's Dam	81	31	53.6	1.10	
Aztec*[1]	71	34	52.4	0.25	
Benson*[1]	70	29	50.0	0.00	
Bisbee	69	20	45.6	0.68	4.0
Buckeye	81	22	50.4	0.90	
Casagrande				1.56	
Champie Camp	86	23	51.5	0.95	3.0
Cochise*[5]	65	26	44.4	T.	
Congress	77	29	52.4	0.52	4.0
Dragoon Summit*[1]	63	26	39.6	0.60	1.5
Dudleyville	79	21	48.5	1.21	
Duncan	73	11[d]	42.0	0.40	T.
Fort Apache	71	11	36.8	0.58	5.8
Fort Defiance	56	−12	27.4	1.31	19.0
Fort Grant	80	20	51.0	0.20	2.0
Fort Huachuca	70	21	47.2	0.17	0.5
Gilabend*[1]	78	30	55.6	0.00	
Globe	75	24	46.6	1.65	11.0
Ingleside	80	29	52.7	0.88	
Jerome	66	19	43.8	1.35	11.5
Kingman	73	17	46.3	0.25	T.
Maricopa				1.00	
Mesa	81	26	50.8	0.62	
Mohawk Summit*[1]	76	35	55.2	0.60	
Mount Huachuca	69	19	46.6	0.56	0.6
Natural Bridge				1.59	12.0
Nogales	77	20	46.6	1.00	3.3
Oracle	67	22	47.4	1.42	7.0
Oro				0.52	
Parker	83	20	52.8	0.05	
Phoenix	81	25	50.6	0.72	
Pima	69	19	44.8	0.18	T.
Pinal Ranch				1.66	14.2
Prescott	67	1	34.6	2.00	22.0
St. Johns	64	8	34.2	0.31	3.0
Arizona—Cont'd.					
San Carlos	70	14	45.3	0.80	T.
Sentinel*[1]	82	31	57.4	0.75	
Showlow				1.70	17.0
Signal	85	19	48.9	0.23	
Silverking				2.35	0.4
Strawberry				2.13	19.0
Superstition				2.10	2.0
Taylor	65	0	33.7	1.00	11.0
Tombstone	70	22	47.6	0.13	T.
Tonto	71	22	45.4	1.16	0.4
Tuba	59	7	34.3	0.10	1.0
Tucson	80	25	50.4	0.53	
Vail*[5]	77	32	55.3	0.07	T.
Walnut Grove				0.45	4.0
Willcox*	65	18	39.8	0.35	3.5
Yarnell				0.92	8.0
Arkansas.					
Alco	71	5	37.0	1.75	3.5
Amity	71	17	36.8	5.93	4.0
Arkansas City				2.51	0.5
Batesville	75	11	37.6		
Blanchard Springs	69	17	40.9	2.54	T.
Brinkley	72	15	38.8	5.65	
Camden *a*				6.46	11.6
Camden *b*	70	20	40.7	6.51	
Conway	76	14	38.7	4.46	T.
Corning	70	10	33.7	4.05	T.
Dallas	70	15	38.6	3.34	0.5
Dardanelle				1.82	
Dutton	66	2	35.2	2.00	1.5
Elon	72[e]	17[e]	39.4[e]	2.40	
Fayetteville	69	2	35.4	0.96	1.5
Fulton				4.70	1.4
Hardy	66	7	36.1	2.42	
Helena *a*				6.26	
Helena *b*	70	10	40.8	5.40	
Ione	70	12	37.4	1.84	3.0
Jonesboro	78	13	41.0	7.04	
Keesees Ferry	73	5	35.6	1.11	4.5
Lacrosse	71[e]	7[e]	35.0[e]		
Lutherville	71	12	38.1	2.22	2.0
Malvern	73	16	39.8	6.95	3.0
Marianna	69	16	38.8	7.03	T.
Marvell	71	16	39.5	5.30	0.7
Mossville	66	3	33.6	2.13	5.7
Mount Nebo	65	8	36.4	2.71	T.
New Gascony	72	12	38.6	5.82	3.2
Newport *a*				6.33	4.0
Newport *b*	73	13	36.9	6.79	
Newport *c*	72	13	37.8	6.97	4.1
Oregon	73	2	35.0	1.02	T.
Osceola	71	12	38.8	7.03	3.0
Ozark	69	12	38.0	2.79	4.2
Pinebluff	71	18	38.4	8.51	2.0
Pocahontas	72	10	35.2	3.71	1.0
Pond	70	2	34.4	1.52	1.5
Prescott	79	19	40.7	6.02	T.
Rison	70[d]	15[d]	35.0[d]	7.47	
Rosadale	72	19	40.7	4.17	3.0
Russellville	69	15	37.5	2.42	2.0
Silversprings	71	3	35.1		1.3
Spielerville	73	3	36.8	1.86	3.0
Stuttgart	71	16	38.6	6.17	3.9
Texarkana	70	20	43.2	2.98	
Warren	75[f]	18	41.8[e]	4.09	2.0
Washington	64	20	40.7	4.60	T.
Wiggs	71	12	37.2	4.39	3.2
Winchester	71	19	40.4		
Winslow	64	2	34.8	2.46	7.0
Witts Springs	66	3	35.0	2.49	3.5
California.					
Angiola	68	19	43.6	0.45	
Azusa	85	30	54.5	1.53	
Bakersfield	72	22	42.6	0.44	
Ballast Point L. H				1.44	
Bear Valley				2.45	21.0
Berkeley	57	33	45.6	1.36	
Bishop	71	9	39.0	0.07	0.8
Boca*[1]	49	3	24.0	1.30	13.0
Bodie	48	−18	19.7	0.37	
Bowman	61	9	36.4	2.40	16.5
Branscomb				4.03	
Caliente*[1]	62	32	44.9	1.70	
Campbell	66	25	44.4	0.71	
Cape Mendocino L. H				3.15	
Cedarville	58	−12	28.9	0.92	14.5
Chico*[1]	70	28	46.2	1.30	
Cisco*[1]	52	8	31.6	1.54	12.5
Claremont	83	25	51.4	1.56	T.
Corning*[1]	71	30	46.6	1.85	
Crescent City	61	30	45.6	7.09	
Crescent City L. H				6.55	
Cuyamaca*[5]	61	9	33.6	8.17	25.0
Delano*[1]	68	24	42.7	0.74	
Delta*[1]	68	25	46.2	2.92	7.0
Drytown	59	22	41.1	0.92	
Dunnigan*[1]	60	27	43.3	0.98	
Durham*[5]	58	28	43.4	2.47	
California—Cont'd.					
East Brother L. H				2.45	
Edmanton*[1]	58	8	33.2	2.38	16.0
Elcajon	88	28	53.0	2.28	
Elmdale	62	21	41.8	0.55	
Elsinore	90	18	51.7	2.30	5.0
Escondido	85	24	50.4	2.59	
Fallbrook	84	29	52.3	2.84	2.0
Folsom City*[1]	62	26	44.5	0.92	
Fordyce Dam				3.65	21.0
Fort Ross	64	33	48.9	4.72	
Foster				2.91	
Georgetown	66	22	44.4	1.92	T.
Gilroy (near)	70	21	45.6	1.02	
Glendora				2.40	
Goshen*[5]	65	25	45.0	0.50	
Grass Valley				2.14	T.
Greenville	60	−2	33.0	1.06	8.0
Hanford	67	25	45.6	0.40	
Healdsburg	72	25	44.0	2.52	
Hollister	66	21	44.1	1.19	
Humboldt L. H				2.78	
Idylwild	70	6	38.8	2.42	24.2
Imperial	84	24	55.2	0.75	T.
Indio*[1]	84	30	53.5	0.40	
Iowa Hill*[1]	63	24	44.6	1.15	
Irvine	92	36	59.1	1.40	
Jackson	62	23	40.8	1.25	T.
Jolon				0.99	
Keene				1.57	
Kennedy Gold Mine	56	20	38.0	1.53	
Kent	57	25	43.7	3.72	
Kernville				0.30	
Kono Tayee	58	29	43.7	1.31	
Lamesa				2.42	T.
Laporte*[1]	55	8	31.9	2.64	18.8
Las Fuentes Ranch				1.31	
Legrande		23		0.37	
Lemoncove	73	25	45.0	0.56	
Lemoore*[5]	64	22	42.8	0.30	
Lick Observatory	63	13	40.9	1.44	T.
Lime Point L. H				1.70	
Lodi	59	24	43.2	0.58	
Los Gatos *b*	63	27	44.6	1.28	
Mammoth*[1]	80	35	54.5	0.00	
Manzana	72	20	44.7	0.67	
Mare Island L. H				1.91	
Merced *b*	60	23	40.9	0.80	
Mills College				1.32	
Milo				1.00	
Milton (near)	59	28	42.4	0.90	
Modesto*[1]	73	31	47.2	0.75	
Mohave*[1]	65	20	45.5	0.17	
Mokelumne Hill*[3]		28	39.8	1.05	T.
Monterio	72	20	47.1	0.70	7.0
Monterey*[1]	63	28	50.6	1.81	
Mount St. Helena				2.80	
Napa *b*	64	27	43.6	1.58	
Needles	75	34	55.8	0.05	
Nevada City	72	15	41.2	1.91	1.0
Niles	66	30	45.8	1.48	
North Bloomfield	68	19	41.2	1.60	3.5
North Ontario	76	28	51.6	1.51	
North San Juan*[1]	66	22	43.8	1.66	0.5
Oakland *a*	58	32	45.7	2.37	
Ogilby*[1]	88	39	61.5		
Oleta*[1]	60	24	40.0	1.07	
Orland*[1]	65	25	44.0	1.53	
Palermo	61	23	41.9	1.55	
Paso Robles	69	19	43.8	1.05	
Peachland*[5]	61	27	44.8	3.25	
Piedras Blancas L. H				1.80	
Pigeon Point L. H				1.65	
Pilot Creek				2.39	13.5
Pine Crest	82	36	56.8	1.29	
Placerville	59	18	39.6	1.35	
Point Ano Nuevo L. H				2.19	
Point Arena L. H				3.75	
Point Bonita L. H				2.69	
Point Conception L. H				0.96	
Point Fermin L. H				1.20	
Point Hueneme L. H				1.06	
Point Lobos	61	36	47.2	2.19	
Point Loma L. H				0.68	
Point Montara L. H				2.60	
Point Pinos L. H				1.81	
Point Sur L. H				3.09	
Pomona (near)	86	28	53.0	1.92	T.
Poway				2.47	
Quincy	49	3	32.1	0.98	9.0
Redding	68	28	44.2	1.37	0.5
Redlands	79	30	52.6	1.64	0.5
Reedley	70	21	43.8	0.34	
Represa	60	26	43.3	0.99	
Riovista	61	25	43.4	0.47	
Riverside	84	26	51.6	0.90	1.0
Roe Island L. H				1.18	
Rohnerville	64	26	45.9	2.75	
Rosewood	68	18	42.0	1.16	T.

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Sacramento	60	27	44.3	0.87	
Salinas*[1]	71	28	50.2	1.01	
Salton*[1]	84	28	57.0	......	
San Bernardino	86	24	52.4	1.65	T.
San Jacinto	84	25	51.4	1.55	
San Jose	68	27	47.4	0.81	
San Leandro	63	28	44.8	1.65	
San Luis L. H.	......	......	......	1.69	
San Mateo*[1]	59	32	47.2	1.92	
San Miguel*[1]	67	20	45.6	0.85	
Santa Barbara	84	35	54.8	1.36	
Santa Barbara L. H	......	......	......	1.48	
Santa Clara	......	......	......	0.73	
Santa Cruz	70	26	47.2	2.31	
Santa Cruz L. H.	......	......	......	2.14	
Santa Maria	85	26	51.4	1.73	
Santa Monica	82	33	52.2	1.10	
Santa Paula	85	35	57.7	1.30	
Santa Rosa*	67	25	49.4	1.79	
Shasta	73	25	46.4	2.77	1.0
Sierra Madre	80	33	54.8	1.80	T.
Snedden	......	......	......	0.61	7.0
Sonoma	......	......	......	1.66	
Stockton	58	25	41.7	0.68	
Storey	65	26	43.1	0.60	
Summerdale	67	7	38.2	1.89	11.0
Susanville	53	− 2	30.8	0.70	9.0
Tehama*[1]	64	30	46.4	2.00	
Tejon Ranch	71	30	44.6	1.61	
Templeton*[1]	56	20	37.2	1.60	
Trinidad L. H	......	......	......	3.09	
Truckee*[1]	48	−20	25.5	1.10	11.0
Tulare *b*	......	......	......	0.42	
Tulare *c*	78	20	44.3	0.40	
Ukiah	65	21	42.4	2.48	
Upperlake	70	21	43.0	1.35	
Upper Mattole*[1]	70	23	43.1	6.43	
Vacaville*[1]	68	28	44.4	1.43	
Ventura	87	34	55.9	1.63	
Visalia *b*	76	21	44.6	0.64	
Volcano Springs*[1]	84	28	53.9	0.58	
Wasco	70	28	45.1	0.35	
Westpoint	......	......	......	1.37	
West Saticoy	......	......	......	1.60	
Wheatland	60	26	42.9	1.35	
Williams*[1]	63	33	46.2	0.83	
Wilmington*[1]	77	35	51.7	1.03	
Wire Bridge*[5]	60	23	43.8	1.51	
Yerba Buena L. H.	......	......	......	1.20	
Yreka	56	15	36.4	0.39	T.
Zenia	......	......	......	3.61	T.
Colorado.					
Alford	64	−25	27.4	0.57	9.0
Arkins	......	......	......	0.32	7.9
Ashcroft	......	......	......	1.26	20.0
Blaine	74	−11	32.3	0.34	4.0
Boulder	65	−20	32.1	0.37	7.2
Boxelder	......	......	......	0.16	2.5
Breckenridge	43	−29	14.1	0.38	7.2
Buenavista	......	......	......	0.26	4.0
Canyon	68	−20	31.6	0.74	6.8
Castlerock	69	−22	27.4	0.11	2.4
Cedaredge	60	− 6	31.2	0.48	6.1
Cheyenne Wells	68	−14	28.8	T.	T.
Clearview	54	−10	25.2	0.79	12.5
Collbran	48	−13	24.4	0.40	6.8
Colorado Springs	65	−16	27.6	0.14	2.8
Delta	54	− 6	28.0	0.30	2.8
Durango	60	−10	30.7	0.70	11.0
Fort Collins	62	−31	24.4	0.32	6.8
Fort Morgan	63	−20	26.6	T.	T.
Fox	65	−17	27.0	0.02	0.8
Garnett	52	−10	20.6	0.15	2.8
Gilman	......	......	......	1.14	18.5
Gleneyre	65	−18	27.0	0.31	3.8
Glenwood	......	......	......	0.75	12.0
Greeley	59	−24	25.6	0.12	2.5
Grover	......	......	......	0.15	2.0
Gunnison	48	−29	13.2	0.37	7.5
Hamps	68	−19	27.0	0.23	2.5
Hoehne	66	−10	31.3	0.15	1.3
Holly	67	− 9	31.8	0.24	1.8
Holyoke (near)	63	−21	26.6	0.09	1.5
Hugo	......	......	......	0.10	2.0
Husted	67	−18	25.2	0.14	2.8
Lake Moraine	47	− 8	21.7	0.48	9.0
Lamar	72	− 8	33.0	0.28	2.0
Laporte	......	......	......	0.52	9.0
Las Animas	69	−11	30.2	0.25	1.5
Lay	48	−29	19.2	0.43	7.5
Leadville (near)	......	......	......	0.51	10.5
Leroy	64	−20	26.8	0.12	1.7
Longs Peak	51	−15	22.8	0.15	3.5
Marshall Pass	......	......	......	0.77	15.0
Meeker	52	−28	21.0	0.50	13.1
Mitchell	......	......	......	0.84	14.0
Montrose	......	......	......	0.41	6.5
Moraine	57	−13	26.2	0.25	5.0
Colorado—Cont'd.	°	°	°	*Ins.*	*Ins.*
Parachute	50	−15	27.5	0.89	10.2
Perrypark	......	......	......	0.33	5.5
Rangely	51	−22	20.6	0.28	5.7
Rockyford	68	−10	29.7	0.18	3.0
Rogers Mesa	59	− 5	29.2	0.31	3.5
Ruby	......	......	......	2.60	40.0
Russell	52	−18	19.9	1.88	25.0
Saguache	59	−16	25.0	0.22	3.9
Salida	65	− 8	28.4	0.14	2.8
San Luis	55	−18	24.4	0.48	5.6
Sapinero	......	......	......	0.98	13.0
Seibert	......	......	......	T.	T.
Silt	51	− 6	28.2	0.42	6.0
Sugarloaf	......	−18	......	0.15	3.0
Telluride	51	−15	21.9	1.05	17.6
Trinidad	65	−11	33.0	0.60	4.6
Twinlakes	......	......	......	0.27	5.2
Vilas	......	......	......	0.03	0.8
Wagon Wheel	53	−30	17.7	0.41	8.5
Walden	44	−17	17.2	0.17	3.2
Wallet	......	......	......	0.10	2.0
Westcliffe	57	− 4	25.8	1.17	16.6
Whitepine	......	......	......	1.00	10.6
Wray	68	−16	28.7	0.20	4.0
Yuma	......	......	......	0.07	1.5
Connecticut.					
Bridgeport	45	6	26.6	2.68	7.2
Canton	47	− 2	22.0	3.11	5.5
Colchester	50	2	25.8	2.99	9.5
Falls Village	......	......	......	2.12	8.2
Hartford *b*	49	1	25.1	2.12	5.8
Hawleyville	48	0	25.6	3.22	6.5
Lake Konomoc	......	......	......	2.36	......
Middletown	51	0	25.4	2.27	7.8
New London	48	4	24.8	2.09	6.2
North Grosvenor Dale	51	1	23.4	2.49	......
Norwalk	48	2	25.0	2.57	6.8
Southington	51	− 1	25.7	2.10	5.8
South Manchester	......	......	......	1.60	8.0
Storrs	50	− 1	23.8	2.53	5.0
Voluntown	52	− 4	24.8	2.65	6.5
Wallingford	......	......	......	2.07	4.8
Waterbury	50	2	25.8	3.43	10.0
West Cornwall	46	− 5	20.4	3.26	10.3
West Simsbury	......	......	......	2.77	4.0
Winsted	46	− 4	21.4	......	......
Delaware.					
Milford	58	11	33.6	4.00	......
Millsboro	64	8	31.8	2.86	4.0
Newark	49	11	28.6	3.98	8.0
Seaford	52	12	32.0	3.73	3.5
District of Columbia.					
Distributing Reservoir*[5]	47	18	31.3	4.34	......
Receiving Reservoir*[5]	44	12	30.2	3.60	......
West Washington	53	5	31.0	3.90	6.3
Florida.					
Archer	80	18	52.8	0.32	
Avon Park	84	25	58.4	0.27	
Bartow	89	21	58.8	0.23	
Bonifay	78	19	50.0	3.26	
Brooksville	78	26	53.2	0.35	
Carrabelle	70	26	50.8	0.78	
Clermont	83	29	58.8	1.42	
De Funiak Springs	76	18	51.0	0.96	
Deland	85	18	55.2	......	
Eustis	83	27	57.0	0.51	
Federal Point	80	22	52.7	0.73	
Fernandina	77	29	51.1	0.50	
Flamingo	78	34	62.0	T.	
Fort Meade	86	19	56.8	0.56	
Fort Myers	80	31	57.3	0.52	
Fort Pierce	82	33	58.7	2.99	
Gainesville	89	22	53.2	0.27	
Holt	82	21	52.5	2.90	
Huntington	81	20	55.0	0.17	
Hypoluxo	80	39	64.0	2.10	
Inverness	80	17	52.8	0.46	
Jasper	76	20	51.3	0.44	
Kissimmee	81	22	57.2	0.19	
Lake Butler	78	19	52.2	0.48	
Lake City	79	25	53.8	0.46	
Macclenny	82	17	52.4	0.41	
Manatee	83	28	57.6	0.53	
Marco	81	35	62.0	0.21	
Marianna	......	18	......	0.70	
Merritt Island	80	36	58.2	0.69	
Miami	80	38	63.7	0.00	
Micanopy	80	19	53.8	0.10	
Middleburg	80	15	51.2	0.13	
New Smyrna	82	21	54.1	1.10	
Nocatee	84	24	58.6	0.22	
Ocala	82	19	55.0	0.22	
Orange City	85	17	54.6	0.75	
Orlando	79	26	56.6	1.25	
Plant City	81	20	56.5	0.29	
Quincy	83	19	52.0	0.67	
Rockwell	81	20	53.3	0.00	
St. Andrews	76	19	50.1	0.08	
Florida—Cont'd.	°	°	°	*Ins.*	*Ins.*
St. Augustine	74	28	54.6	0.00	
St. Leo	82	29	56.9	0.65	
Sumner	82	15	53.6	T.	
Switzerland	79	22	51.4	0.12	
Tallahassee	75	26	51.8	1.05	
Tarpon Springs	82	25	55.4	0.60	
Titusville	84	26	56.0	0.86	
Waukeenah	80	20	52.2	1.52	
Wausau	80	16	50.6	0.57	
Wewahitchka	79	20	50.0	0.77	
Georgia.					
Adairsville	62	17	39.4	3.70	T.
Albany	69	27	49.6	1.36	
Allapaha	78	22	46.1	0.48	
Allentown	74	21	46.6	0.54	
Alpharetta	67	17	39.2	3.34	T.
Americus	72	18	44.6	0.93	
Athens	65	19	40.2	2.70	
Bainbridge	77	24	49.2	0.87	
Blakely	76	......	......	1.23	
Bowersville	67	18	39.9	4.11	
Brent	68	19	43.4	1.26	
Camak	67	21	43.8	1.00	
Canton	......	......	......	2.94	
Carlton	......	......	......	1.82	
Clayton	63	10	37.6	3.25	1.0
Columbus	64	23	44.5	2.25	
Covington	68	18	41.4	2.79	T.
Dahlonega	67	17	40.4	3.12	0.5
Diamond	63	12	37.4	2.47	1.2
Dublin	......	......	......	1.15	
Elberton	66	20	42.4	2.96	
Experiment	66	19	42.6	2.04	
Fitzgerald	80	19	47.6	0.72	
Fleming	80	14	48.6	0.65	
Fort Gaines	73	21	47.0	1.03	
Gainesville	60	20	38.7	2.83	
Gillsville	68	12	41.8	3.12	T.
Greenbush	70	7	38.5	1.99	
Griffin	65	20	42.2	1.65	
Harrison	73	19	45.8	0.62	
Hawkinsville	78	19	45.3	2.35	
Hephzibah	......	......	......	0.85	
Jesup	77	19	49.0	0.76	
Lost Mountain	69	17	41.6	3.78	
Louisville	73	21	46.0	1.58	
Lumpkin	72	19	47.6	3.08	
Marshallville	69	22	46.8	1.00	
Mauzy	81[d]	17[d]	49.7[d]	0.57	
Milledgeville	65	21	42.5	2.55	
Millen	77	18	48.5	T.	
Morgan	77	17	46.2	1.34	
Naylor	79	17	49.9	0.50	
Newnan	62[e]	17[e]	39.2[e]	1.72	
Oakdale	......	......	......	3.26	
Point Peter	68	16	39.8	4.27	
Poulan	81	16	47.8	0.92	
Putnam	73	19	46.8	0.90	
Quitman	76	18	48.8	1.09	
Ramsey	64	15	40.0	2.92	
Resaca	......	......	......	3.36	
Rome	65	16	39.4	3.64	
St. Marys	80	20	50.4	0.35	
Talbotton	70	19	44.9	2.04	
Thomasville	78	23	51.0	0.79	
Toccoa	67	17	38.5	1.88	
Valona	79	17	48.7	0.54	
Vidalia	79	21	46.8	1.08	
Washington	64[d]	12[b]	38.6[e]	1.74	
Waverly	82	17	50.3	0.75	
Waycross	75	21	47.2	6.92	
Waynesboro	74	22	44.8	0.47	
Westpoint	65	17	43.0	1.75	
Woodbury	68	18	42.0	1.53	
Idaho.					
Albion	56	−20	27.9	0.88	12.0
American Falls	51	−27	21.8	0.52	5.2
Blackfoot	49	−29	20.4	0.55	5.5
Burnside	48	−21[f]	14.1[f]	0.55	......
Challis	46	−20	19.9	0.50	5.0
Chesterfield	44	−32	16.6	0.60	8.0
Downey[e]	45	−24	18.8	0.40	4.0
Forney	51	−30	16.0	0.66	6.0
Garnet	55	− 5	30.8	0.45	2.0
Grangeville	......	−15	......	1.89	18.9
Hailey	50	−25	22.2	0.54	5.4
Idaho City	50	−16	24.0	0.26	2.6
Lake	38	−34	10.2	0.30	3.0
Lakeview	54	−11	27.8	1.90	4.0
Lost River	45	−26	18.6	0.07	0.8
Moscow	53	−12	26.8	2.29	14.2
Murray	50	−13	23.2	1.90	6.0
Oakley[e]	55	−18	26.4	0.50	5.0
Ola	49	−17	26.6	1.29	16.3
Paris	61	−27	24.2	0.22	2.2
Payette	55	−13	27.0	0.86	5.8
Pollock	57	0	31.6	0.03	......
Porthill	45	−16	24.5	1.64	2.0

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Temperature. (Fahrenheit.) Minimum.	Temperature. (Fahrenheit.) Mean.	Precipitation. Rain and melted snow.	Precipitation. Total depth of snow.
	°	°	°	Ins.	Ins.
Idaho—Cont'd.					
Priest River	52	−15	25.0	1.75	5.5
St. Maries	52	−14	28.0	1.27	7.5
Soldier	44	−33	19.4	0.55	5.8
Swan Valley	45	−22	21.3	0.27	5.8
Vernon	45	−30	17.6	0.32	5.2
Weston	48e	−12e	26.3e	0.27	2.5
Illinois.					
Albion	58	1	30.6	2.00	5.4
Aledo	54	−20	24.0	0.58	6.5
Alexander	58	−11	27.4	0.70	9.0
Antioch	45	−11	22.8	0.45	4.5
Ashton	52	−17	22.8	0.73	7.5
Astoria	58	−10	26.4	1.70	15.5
Aurora *a*	51	−16	23.6	0.56	8.0
Bloomington	57	−9	26.6	0.90	9.6
Cambridge	52	−14	23.6	0.62	6.2
Carlinville	60	−9	28.7	1.14	8.8
Centralia	62	0	32.0	1.09	6.8
Charleston	56	−5	28.9	0.97	7.4
Chemung	47	−20	21.8	0.42	4.1
Chester	.....	.....	.....	1.54	T.
Cisne	64	2	31.6	1.48	1.0
Coatsburg	54	−11	27.2	0.48	4.7
Cobden	66	3	34.3	1.52	T.
Danville	50	−5	26.4	0.98	10.0
Decatur	58	−12	26.8	1.06	12.5
Dixon	51	−18	23.3	0.43	4.9
Dwight	53	−11	25.4	0.44	8.0
Effingham	58b	10c	32.5b	0.87	5.0
Equality	68	4	33.8	2.55	3.5
Flora	60	0	31.4	1.25	0.5
Friendgrove*	60	2	32.0	1.62	2.2
Galva	54	−17	23.7	0.44	10.5
Grafton	.....	.....	.....	1.03	9.0
Greenville	59	−6	29.2	0.61	6.1
Griggsville	63	−9	28.6	0.56	5.6
Halfway	63	4	33.1	1.87	.....
Halliday	65	2	34.6	1.42	.....
Havana	56	−9	26.8	0.85	8.5
Henry	58	−16	25.2	0.46	7.9
Hillsboro	56	−8	27.4	0.82	8.7
Joliet	51	−12	23.5	0.55	5.8
Kishwaukee*	52	−19	22.2	0.48	5.0
Knoxville	55	−15	25.0	0.52	5.2
Lagrange	50	−13	24.1	0.53	6.5
Laharpe	58	−13	25.2	0.65	5.5
Lanark	54	−24	21.8	0.46	4.3
McLeansboro	61	3	31.6	1.93	0.7
Martinsville	.....	.....	.....	0.54	5.0
Martinton	57	−6	26.0	0.83	10.5
Mattoon	58	−5	32.0	1.15	10.2
Minonk	52	−11	24.4	0.48	6.8
Monmouth	53	−16	23.1	0.30	4.7
Monticello	57	−8	26.4	1.83	11.7
Morgan Park	.....	.....	.....	0.45	4.5
Morrison	55	−21	22.6	0.82	8.6
Morrisonville	56	−11	27.6	1.00	8.5
Mount Carmel	.....	.....	.....	2.37	9.5
Mount Pulaski	57	−11	26.8	0.67	11.7
Mount Vernon	62	7	31.4	1.45	2.0
New Burnside	62	4	33.2	2.89	16.2
Olney	56	0	30.5	1.41	9.2
Ottawa	54	−14	26.0	0.63	6.3
Palestine	55	1	29.9	2.46	4.5
Pana	55	−10	28.2	1.47	12.0
Paris	55	−3	27.6	0.87	.....
Peoria *a*	.....	.....	.....	0.63	8.5
Peoria *b*	55	−9	29.2	0.62	6.3
Philo	58	−6	26.3	1.02	11.5
Plumhill	63	−1	31.0	1.21	5.0
Rantoul	56	−7	27.0	0.77	8.7
Raum	65	5	33.7	3.56	2.0
Riley	48	−16	22.2	0.55	6.4
Robinson	59	0	30.6	1.05	3.0
Rushville	58	−10	26.8	0.67	9.8
St. Charles*	46	−16	22.5	0.83	8.3
St. John	64	0	31.2	1.51	1.0
Scales Mound	51	−22	20.8	0.66	6.8
Shobonier	58	−5	29.0	1.15	10.3
Strawn	57	−8	26.5	0.97	5.5
Streator	54	−11	25.1	0.79	8.0
Sullivan	58	−10	27.6	1.05	10.5
Sycamore	49	−15	23.4	0.70	7.0
Tilden	63	0	31.6	0.96	3.8
Tiskilwa	52	−16	23.4	0.55	5.5
Tuscola	57	−7	26.6	1.24	10.3
Walnut	51	−14	25.0	0.38	5.7
Wellington	54	−5	27.0	0.80	8.0
Winchester	58	−8	28.4	1.52	10.5
Winnebago	51	−18	22.0	0.63	8.0
Yorkville	44	−21	23.0	0.56	5.6
Zion	44	−22	21.6	0.50	5.0
Indiana.					
Anderson	52	0	28.4	0.67	6.6
Angola	43	−3	23.7	1.10	8.8
Auburn	47	−2	25.4	0.43	2.7
Bloomington	53	2	30.1	0.90	7.0
Bluffton	53	−2	27.1	0.85	.....
Indiana—Cont'd.					
Butlerville	59	5	30.5	2.48	5.0
Cambridge City	52	1	25.0	1.14	3.3
Columbus	60	4	30.6	1.39	3.0
Connersville	55	2	28.0	0.89	4.0
Crawfordsville	67	0	29.9	.....	.....
Delphi	55	−2	25.4	0.85	10.0
Edwardsville*	58	5	32.5	4.05	2.8
Farmland	48	1	27.8	0.96	8.5
Fort Wayne	49	−2	26.2	0.49	5.0
Franklin*[1]	57	4	29.4	1.01	3.0
Greencastle	52	0	28.0	0.61	4.7
Hammond	51	−12	23.6	1.44	13.0
Hector	51	−2	27.4	0.20	2.0
Huntington	51	1	26.3	1.41	14.5
Jeffersonville	59	9	32.5	4.48	3.5
Knightstown	52	1	28.6	1.06	4.0
Kokomo	53	1	28.3	0.78	7.1
Lafayette	54	−1	27.0	0.87	9.0
Laporte	51	−5	26.4	0.96	9.8
Logansport	48e	−1	25.8	2.88	.....
Madison *a*	61	7	30.0	3.34	9.0
Madison *b*	.....	.....	.....	2.67	.....
Marengo	60	9	30.8	1.76	3.5
Marion	54	−2	27.4	1.05	10.5
Markle	53	−2	26.8	0.85	8.5
Mauzy	56	1	28.0	0.98	5.1
Mount Vernon	62	5	31.9	2.63	T.
Northfield	53	−2	26.5	0.80	8.0
Paoli	61	6	31.2	2.53	5.5
Prairie Creek	58	0	29.8	0.61	2.5
Princeton	59	4	30.1	1.70	7.0
Rensselaer	52	−5	26.4	1.03	10.0
Richmond	53	3	28.0	0.75	3.0
Rockville	55	−2	27.6	0.39	3.0
Salem	64	5	31.8	3.06	3.0
Scottsburg	60	7	32.1	2.98	4.5
Seymour	58	7	30.2	2.63	11.0
South Bend	47	−6	25.2	1.16	15.0
Syracuse	45	−5	24.7	1.08	13.4
Terre Haute	58	0	30.0	0.86	5.8
Topeka	43	−1	24.6	0.40	4.0
Valparaiso	48	−10	23.9	0.68	.....
Veedersburg	58e	−3e	27.4e	.....	.....
Vevay	60	9	32.4	2.70	6.0
Vincennes	57	3	29.5	1.83	2.5
Washington	61	5	31.5	2.01	8.3
Winamac	54	4	24.8	.....	.....
Worthington	58	2	29.5	1.29	5.7
Indian Territory.					
Ardmore	74	9	41.0	0.33	
Bengal	68	8	37.8	1.40	1.0
Chickasha	70	3	37.8	0.10	0.2
Durant	74	10	40.4	1.01	.....
Fairland	69	3	38.8	1.01	.....
Hartshorne	73	8	40.2	1.82	5.0
Healdton	71	7	38.3	0.03	T.
Holdenville	70	4	38.3	0.90	T.
Marlow	70	−1	40.2	0.05	T.
Muscogee	70	6	36.6	0.98	2.0
Pauls Valley	71	5	36.9	0.16	T.
Roff	70	8	40.0	0.60	
Ryan	72	8	41.9	0.02	T.
South McAlester	.....	.....	.....	1.43	0.5
Tahlequah	73	5	36.0	1.50	7.0
Tulsa	.....	.....	.....	1.20	5.0
Webbers Falls	72e	8e	37.8e	1.72	4.3
Iowa.					
Afton	54	−17	24.3	1.30	13.0
Albia	60	−16	26.1	0.82	8.2
Algona	48	−18	21.1	1.04	10.4
Alta	45	−20	20.0	0.94	14.4
Amana	49	−22	22.0	0.88	8.3
Ames *b*	49	−23	21.8	1.32	14.5
Atlantic	59	−31	22.4	1.70	17.0
Baxter	55	−21	21.2	0.70	7.0
Belknap	.....	−18	.....	0.60	6.0
Belleplaine	50	−22b	20.4d	1.07	10.7
Bonaparte	58	−16	24.9	0.55	3.5
Britt	49	−22	19.0	0.55	5.5
Buckingham	.....	.....	.....	1.09	10.4
Burlington	61	−14	24.7	0.89	.....
Bussey	.....	.....	.....	1.00	10.0
Carroll	54	−21	22.4	1.35	13.5
Cedar Rapids	52	−23	22.2	1.03	10.4
Centerville	60	−16	26.4	0.30	3.0
Chariton	60	−20	24.4	0.74	8.0
Charles City	48	−27	25.2	0.65	8.5
Clarinda	60	−21	25.7	1.23	13.2
Clearlake	60	−22	23.4	0.90	9.0
Clinton	52	−15	22.3	0.63	6.3
College Springs	58	−17	25.4	1.05	10.5
Columbus Junction	53	−15	24.4	0.46	6.5
Corning	55	−25	23.0	1.50	14.5
Council Bluffs	56	−19	25.8	1.05	12.0
Cresco	43	−23	17.4	0.60	6.0
Cumberland	.....	.....	.....	1.10	11.0
Decorah	47	−30	18.8	1.20	9.0
Delaware	44	−22	19.5	0.67	8.0
Iowa—Cont'd.					
Denison	52	−27	22.4	1.00	10.0
De Soto	57	−13	25.0	0.80	8.0
Dows	54	−24	20.1	0.75	7.5
Eldon	57	−18	24.4	0.65	6.5
Elkader	51	−30	20.7	0.77	12.0
Estherville	50	−25	19.4	0.36	4.8
Fairfield	57	−17	24.3	0.55	5.5
Fayette	47	−30	18.5	0.82	8.6
Fonda	.....	.....	.....	1.50	15.5
Forest City	49	−20	20.0	0.72	7.0
Fort Dodge	55	−30	20.2	0.90	9.0
Fort Madison	.....	.....	.....	1.10	11.0
Galva	49	−20	21.1	0.50	5.0
Gilman	.....	.....	.....	0.72	7.2
Glenwood	55	−16	25.2	0.73	8.5
Grand Meadow	45	−25	18.6	0.85	8.5
Greene	52	−24	20.2	0.58	5.8
Greenfield	56	−18	24.5	0.91	9.2
Grinnell	50	−16	22.7	0.49	5.9
Grinnell (near)	50	−20	21.7	0.80	10.5
Grundy Center	51	−25	20.1	1.16	10.5
Guthrie Center	56	−23	23.0	1.25	12.5
Hampton	50	−19	21.6	1.46	15.2
Harlan	54	−22	22.4	1.67	17.5
Hopeville	.....	.....	.....	0.53	.....
Humboldt	58	−22	24.4	0.45	8.0
Independence	47	−24	19.6	0.93	9.3
Indianola	60	−20	24.3	0.84	8.4
Iowa City	53	−23	21.1	1.29	14.0
Iowa Falls	53	−25	17.9	1.69	18.0
Jefferson	.....	.....	.....	0.95	9.7
Keosauqua	55	−15	25.5	0.58	5.6
Knoxville	57	−17	24.8	0.68	7.5
Lacona	.....	.....	.....	1.15	9.5
Larrabee	47	−22	20.4	0.95	11.6
Leclaire	.....	.....	.....	0.55	8.5
Lemars	48	−24	21.6	0.98	11.0
Lenox	53	−24	23.8	0.70	7.0
Logan	56	−21	24.0	1.30	13.0
Maple Valley	.....	.....	.....	0.75	7.5
Maquoketa	57	−29	21.4	0.73	.....
Marshalltown	50	−23	23.0	1.11	8.3
Monticello	52	−28	20.2	0.68	9.0
Mountayr	56	−23	23.9	1.45	14.0
Mount Pleasant	54	−17	22.7	0.19	.....
Mount Vernon	52	−21	21.7	0.90	10.2
New Hampton	47	−22	19.2	0.90	9.0
Newton	50	−22	22.6	1.37	14.0
Northwood	47	−18	20.1	0.80	8.0
Odebolt	49	−21	21.6	0.91	12.0
Ogden	58	−24	23.1	1.08	14.0
Olin	48	−28	20.7	0.80	8.5
Onawa	55	−23	23.6	1.15	14.0
Osage	46	−22	18.8	0.57	5.8
Oskaloosa	57	−17	23.6	0.28	4.2
Ottumwa	55	−12	25.9	0.60	6.0
Ovid	59	−20	24.4	0.81	8.0
Pacific Junction	54	−21	24.3	0.93	9.3
Pella	63	−22e	23.3	0.55	5.5
Perry	57	−22	23.2	0.95	8.5
Plover	51	−25	20.8	0.60	6.0
Primghar	45	−22	20.3	0.45	4.5
Redoak	54	−15	27.4	1.22	12.4
Ridgeway	47	−21	21.4	2.83	15.8
Rockwell City	52e	−21e	22.8e	1.35	15.0
Ruthven	45e	−21	20.2e	0.65	6.5
Sac City	48	−21	20.4	1.45	14.5
St. Charles	63	−16	25.9	1.04	10.5
Scranton	58	−16	22.5	1.20	12.0
Sheldon	51	−23	20.4	0.71	7.1
Sibley	49	−21	19.2	0.30	3.0
Sigourney	54	−18	24.2	0.56	5.5
Sioux Center	49	−20	20.8	0.40	4.0
Spirit Lake	50	−23	20.4	0.60	6.0
Stockport	.....	.....	.....	0.43	6.0
Storm Lake	48	−20	20.1	0.89	10.4
Thurman	63	−27	25.2	0.75	7.5
Tipton	54	−18	23.8	1.10	7.5
Villisca	55	−25	24.8	1.55	13.5
Vinton*	50c	−27	20.9d	0.75	7.5
Wapello	51d	−12d	25.0d	0.31	4.5
Washington	55	−20	22.6	0.49	.....
Washta	.....	.....	.....	1.10	12.5
Waterloo	51	−23	20.4	0.93	10.0
Waverly	50	−25	20.3	0.92	11.0
Westbend	49	−20	20.7	0.70	7.0
West Union	.....	.....	.....	1.20	12.0
Whitten	51	−22	19.5	0.95	9.5
Wilton Junction	52	−21	22.9	0.81	10.0
Winterset	58f	−17	24.7e	1.20	12.0
Woodburn	.....	.....	.....	0.98	9.8
Kansas.					
Abilene	63	−15	29.0	0.90	9.0
Achilles	66	−17	28.8	0.42	4.2
Altoona	.....	−4	.....	0.42	2.5
Anthony	.....	.....	.....	0.40	4.0
Atchison	65	−12	28.7	0.87	8.0
Beloit	62	−16	27.1	0.80	8.0

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
Kansas—Cont'd.					
Burlington	71	−15	30.6	0.99	8.0
Chanute	71	−4	33.4	0.45	4.5
Colby	67	−15	28.2	0.31	3.2
Columbus	63	−1	31.9	1.03	4.6
Delphos	68	−18	28.2	1.03	8.5
Dresden	64	−14	28.6	1.01	9.6
Ellinwood	71	−14	29.6	2.31	19.5
Emporia	65	−7	31.6	1.00	10.0
Englewood	75	−14	32.7	0.50	4.2
Eureka Ranch	72	−15	28.4	0.63	6.3
Fallriver	69	−4	31.6	0.65	2.0
Farnsworth*[1]	68	−4	29.0	0.20	2.0
Fort Scott	70	−6	31.0	1.19	11.5
Frankfort	69	−22	30.2	1.15	11.5
Garden City	67	−10	29.8	0.25	1.5
Gove*	68	−7	30.0	0.40	4.0
Grenola	70	−3	31.4	0.53	6.0
Hanover	67	−20	27.1	0.90	9.0
Harrison	67	−22	26.6	0.83	10.2
Hays	71	−15	30.2	1.00	10.0
Horton	66	−14	28.6	1.42	14.0
Hoxie	65	−14	28.7	1.20	8.0
Hutchinson	71	−14	30.2	1.11	11.0
Independence	66	0	32.8	0.61	3.7
Jetmore	73	−14	32.2	0.47	4.7
Lakin	66	−10	31.4	0.16	2.0
Lawrence	62	−10	30.2	1.65	15.2
Lebanon	63	−20	27.0	0.80	8.0
Lebo	66	−10	29.6	0.89	7.7
Leoti	74	−11	31.4	0.15	1.5
Little River	70	−15	29.8	1.52	15.2
Macksville	70	−16	30.4	1.42	14.5
McPherson	70	−10	30.9	1.99	14.5
Madison	74	−16	29.7	0.71	......
Manhattan	69	−16	29.1	1.09	11.0
Marion	61	−10	30.6	1.80	18.0
Medicine Lodge	69	−10	32.7	0.65	7.0
Minneapolis	67	−17	28.8	0.63	6.3
Moran	69	−8	31.2	0.80	8.0
Mounthope*[1]	66	−7	31.5	1.17	4.0
Ness City	68[d]	−8[d]	30.8[d]	0.88	7.3
Newton	70	−7	32.0	1.05	9.3
Norwich	69	−7	32.8	0.49	5.0
Olathe	64	−12	30.5	1.50	15.0
Osage City	69	−12	29.8	1.15	10.7
Oswego	69	−1	33.8	0.45	3.0
Ottawa	68	−15	29.2	1.18	10.0
Phillipsburg	64	−14	27.8	0.73	6.5
Pratt	72	−15	32.0	0.95	8.0
Rome	69	−6	32.4	0.53	5.0
Salina	65	−15	28.5	1.38	14.0
Sedan	67	0	32.2	0.31	1.5
Seneca	65	−16	28.4	1.25	11.0
Toronto	73	−8	29.0	0.85	4.8
Ulysses	72	−9	32.3	0.15	1.0
Valley Falls	73	−19	28.7	1.39	12.3
Viroqua	72	−12	32.2	0.50	5.0
Wakeeney (near)	......	......	......	0.60	6.0
Wallace*[1]	68	−10	29.9	0.32	2.2
Wamego*[1]	64	−16	30.6	1.32	13.2
Winfield	65	−4	31.6	0.75	4.9
Yates Center	67	−10	29.4	0.54	4.5
Kentucky.					
Alpha	63	13	36.2	6.28	......
Anchorage	61	8	32.6	4.44	......
Bardstown	66	10	34.3	5.47	0.5
Berea	64	6	35.2	6.58	3.5
Blandville	62	7	33.2	4.80	4.3
Bowling Green	65	14	38.0	8.25	1.0
Burnside	64	13	34.0	5.03	0.2
Carrollton	58	8	31.6	3.76	......
Catlettsburg	61	10	33.6	4.33	4.0
Centertown	66	11	34.3	6.40	T.
Earlington	67	10	34.5	6.62	5.1
Edmonton	64	11	34.4	7.37	2.0
Eubank	54	9	31.4	6.68	......
Falmouth	......	......	......	3.57	7.0
Fords Ferry	65[f]	8	33.3[d]	3.46	......
Frankfort	59[h]	10[h]	33.6[h]	4.52	2.0
Franklin	68	15	38.2	4.36	0.5
Georgetown	58	8	32.3		
Greensburg	60	12	32.5	7.54	0.2
Henderson	59	8	32.8	3.63	0.5
Hopkinsville	65	12	35.2	6.75	......
Irvington	57[f]	10[i]	32.8[h]	3.78	2.0
Litchfield	62	10	32.6	6.61	1.6
Loretto	63	7	34.0	4.54	1.5
Manchester	68	8	33.6	4.55	3.0
Marrowbone	70	9	33.2	5.42	3.0
Maysville	60	10	30.0	4.65	10.8
Mount Sterling	57	10	31.8	5.57	......
Owensboro	65	10	35.0	4.80	0.6
Owenton	55	5	30.2	3.87	7.0
Paducah *a*	......	......	......	4.16	1.2
Paducah *b*	69	9	36.8	4.45	T.
Pikeville	61	10	34.4	6.36	3.5
St. John	62	10	33.5	5.65	1.5
Scott	60	6	31.2	2.95	8.0

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
Kentucky—Cont'd.					
Shelby City	63	8	32.0	7.65	2.0
Shelbyville	60	9	33.6	3.43	1.2
Warfield	67	7	35.4	8.10	2.0
Williamsburg	......	......	......	4.12	T.
Louisiana.					
Abbeville	76	27	49.9	0.95	
Alexandria	75	23	44.8	1.68	T.
Amite	79	21	48.6	2.45	
Baton Rouge	78	28	49.8	2.40	
Burnside	......	23	......	2.88	
Calhoun	71	22	40.5	2.26	
Cameron	69	32	49.2	0.48	
Cheneyville	75	24	45.0	2.14	
Clinton	79	25	49.6	2.64	
Collinston	74	21	43.2	2.85	T.
Covington	80[e]	24[e]	51.0[e]	2.27	
Donaldsonville	81	27	51.7	3.27	
Emilie	73	28	50.2	2.70	
Franklin	76	28	49.8	1.57	
Grand Coteau	75	29	40.8	1.61	
Hammond	79	25	51.8	2.35	
Jeanerette	78	28	53.6	1.57	
Jennings	78	26	49.4	3.17	
Lafayette	78	27	48.6	1.35	
Lake Charles	75	28	48.4	0.47	
Lake Providence	84	10	46.0	2.99	T.
Lakeside	76	32	49.2	0.47	
Lawrence[j]	80	28	52.8	0.25	
Libertyhill	75	21	44.6	1.95	T.
Mansfield	72	21	42.4	1.50	0.5
Melville	80	23	47.0	2.60	
Monroe	72	25	43.2	2.15	
New Iberia	......	......	......	0.80	
Opelousas	76	26	47.4	0.83	
Paincourtville	71[d]	27[e]	50.0[f]	3.98	
Plain Dealing	70	20	42.4	4.41	1.4
Prevost	......	......	......	0.49	
Ruddock	74	31	50.2	2.85	
Ruston	71[d]	23[d]	44.2[d]	1.95	T.
Schriever	79	26	53.1	0.66	
Southern University	......	......	......	0.13	
Sugar Ex. Station	76	29	50.4	1.44	
Sugartown	73	28	47.8	1.77	
Venice	80	31	54.8	0.88	
Wallace	79	27	52.5	1.33	
White Sulphur Springs	74	25	46.0	2.38	2.0
Maine.					
Bar Harbor	50	−4	22.1	4.05	9.0
Belfast	47	−2	19.6	3.37	14.0
Calais	45	−10	17.4	4.24	9.0
Cornish	43	−1	19.0	4.18	9.8
Fairfield	45	−15	16.4	2.25	10.0
Farmington	40	−11	16.0	3.06	14.2
Gardiner	46	−7	19.0	2.67	6.5
Kineo	38	−13	12.8	2.15	6.0
Lewiston	56	−5	19.3	3.04	10.2
Mayfield	40	−6	17.2	3.21	10.0
North Bridgton	44	−5	18.4	4.36	12.0
Orono	47	−16	17.3	3.65	13.0
Rumford Falls	39	−6	14.6	1.76	10.0
Winslow	48	−14	18.2	2.31	9.0
Maryland.					
Annapolis	49	16	32.5	3.55	6.0
Bachmans Valley	45	8	27.2	4.60	8.5
Boettcherville	55	6	29.4	3.05	13.0
Boonsboro *a*	51	10	29.6	3.06	10.0
Cambridge	54	17	32.8	3.30	5.5
Charlotte Hall	52[f]	11[f]	31.6[f]	3.45	4.5
Chase	48	7	29.4	3.44	9.0
Cheltenham	51	6	31.2	4.49	5.9
Chewsville	51	3	28.5	3.30	14.0
Clearspring	51	10	28.6	3.11	9.0
Coleman	......	......	......	2.40	9.0
Collegepark	49	8	29.7	3.72	4.5
Colora	......	......	......	4.21	9.0
Cumberland *b*	......	......	......	3.18	12.0
Darlington	59	9	29.2	3.39	9.5
Deerpark	48	−7	23.2	3.75	33.9
Denton	46[g]	15[g]	30.4[g]	1.80	8.0
Easton	52	17	32.0	4.11	8.0
Fallston	48	11	29.8	3.11	9.8
Frederick	49	13	31.0	3.52	10.4
Grantsville	48	2	23.7	3.58	23.2
Greatfalls	55	8	29.8	2.80	......
Greenspring Furnace	51	8	29.0	3.72	9.2
Guard	51	1	26.0	3.89	19.8
Hancock	54[e]	5[e]	28.3[e]	3.63	12.2
Harney	......	......	......	3.18	8.2
Jewell	52	12	32.4	3.05	5.5
Johns Hopkins Hospital	51	13	28.9	3.69	8.0
Laurel	50	8	29.4	3.15	7.2
Longwoods	......	......	......	4.70	6.0
McDonogh	51[d]	12[d]	28.4[d]	3.62	9.0
Mount St. Marys College	49	14	28.5	3.14	11.7
Newmarket	50	12	30.0	3.56	11.5
Pocomoke	59	14	34.1	3.20	5.0
Princess Anne	59	11	33.0	3.21	5.5
Queenstown	53	12	30.3	3.98	8.3

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
Maryland—Cont'd.					
Rockhall *b*	51	10	30.5	3.38	8.0
Sharpsburg	52	7	29.9	2.90	11.2
Smithsburg *b*	49	10	29.0	3.24	11.7
Solomons	53	18	32.8	2.88	6.1
Sudlersville	50[h]	11[h]	30.8[h]	4.25	8.0
Sunnyside	48	−7	24.3	6.75	28.3
Takoma Park	49	11	29.6	3.90	......
Van Bibber	46	12	29.8	3.32	......
Westernport	51	7	27.4	2.25	15.5
Woodstock	50	11	31.0	3.58	6.9
Massachusetts.					
Amherst	51	−2	23.7	2.13	6.5
Bedford	50	−3	23.3	1.67	13.0
Bluehill (summit)	50	1	24.0	2.05	11.4
Cambridge	56	4	25.1	2.36	......
Chestnuthill	52	2	24.5	1.98	10.5
Cohasset	......	......	......	1.74	7.0
Concord	51	−6	22.0	1.66	9.8
East Templeton*	46	−1	21.2	1.46	12.0
Fallriver	51	6	27.7	2.39	8.5
Fitchburg *a**[1]	46	1	22.9	2.00	13.2
Fitchburg *b*	49	1	22.4	2.06	9.0
Framingham	55	0	23.5	2.71	9.0
Groton	49	−3	21.7	2.29	12.0
Hyannis	......	......	......	2.12	7.2
Jefferson	......	......	......	2.96	13.2
Lawrence	51	−3	23.2	2.24	11.8
Leominster	......	......	......	1.96	8.8
Lowell *a*	50	−2	24.8	2.27	......
Lowell *b*	47	−3	24.2	......	......
Ludlow Center	46	−7	19.6	1.78	7.0
Middleboro	53	5	24.4	2.19	7.5
Monson	50	0	23.6	2.30	8.2
New Bedford *a*	51	7	27.7	2.38	6.5
Plymouth*[1]	52	6	27.0	2.22	9.0
Princeton	......	......	......	3.10	12.5
Provincetown	45	10	27.8	2.46	4.5
Somerset*[1]	52	4	26.4	3.40	8.5
Springfield	50	1	29.1	1.33	3.5
Sterling	......	......	......	2.30	9.4
Taunton	51	−5	23.7	2.10	......
Webster	......	......	......	2.00	8.5
Westboro	54	−3	24.4	2.62	10.5
Weston	51	−1	23.9	2.06	12.7
Williamstown	46	−3	21.2	1.24	4.8
Winchendon	......	......	......	2.02	10.0
Worcester	49	2	24.2	1.97	8.0
Michigan.					
Adrian	41	−1	24.1	0.62	6.6
Agricultural College	40	−8	20.5	0.43	4.3
Allegan[d]	44	−6	24.2	0.17	1.7
Alma	39	−7	22.3	0.34	3.0
Ann Arbor	41	−4	22.6	0.60	6.0
Annpere	45	3	25.2	0.30	3.0
Arbela	40	−6	22.0	0.10	1.0
Baldwin	44	−26	20.0	0.20	1.5
Ball Mountain	43	−7	21.6	0.38	3.5
Baraga	......	−11	......	0.90	9.0
Battlecreek	42	−3	23.6	0.32	2.7
Bay City	54	2	24.6	0.08	0.8
Benzonia	42	−4	21.8	1.21	12.1
Berlin	42	−5	21.0	0.50	5.4
Berrien Springs	50	0	25.3	1.75	17.5
Big Rapids	40	−13	19.8	0.35	3.5
Birmingham	40	4	21.6	0.30	3.0
Boon	40	−23	16.8	1.15	11.5
Calumet	38	−12	17.6	3.44	43.0
Carsonville	45	−12	21.8	0.40	4.0
Cassopolis	44	−8	23.6	1.21	12.1
Charlevoix	41	−3	23.6	1.18	11.8
Chatham	45	−19	18.0	2.16	21.6
Cheboygan	42	−7	20.6	0.70	7.0
Clinton	48	−5	24.6	0.35	3.7
Coldwater	52	−3	24.4	0.40	4.0
Deerpark	39	−11	20.8	3.09	31.0
Detour	35	−6	20.0	2.50	25.0
Dundee	41	1	24.4	0.62	6.7
Eagle Harbor	36	−8	20.1	1.87	18.7
East Tawas	42	−9	23.0	0.15	1.5
Eloise	42	−4	23.5	0.28	3.4
Ewen	40	−18	19.5	0.97	9.7
Fairview	38	−4	21.8	0.65	6.5
Fennville	44	−5	24.4	0.55	5.5
Fitchburg	42	−10	21.6	0.70	7.0
Flint	40	−4	21.6	0.42	4.2
Frankfort	37	0	22.6	0.25	2.5
Gaylord	42	−12	18.8	1.41	14.1
Gladwin	41	−12	21.8	0.30	3.0
Grand Rapids	44	−11	24.2	0.40	4.0
Grape	41	−1	24.4	0.50	5.3
Grayling	36	−11	18.0	1.10	10.0
Hanover	43	−5	22.6	0.59	5.8
Harbor Beach	49	−9	22.8	0.87	8.7
Harrison	37	−14	20.2	0.35	3.5
Harrisville	44	−11	19.7	1.57	15.7
Hart	43	−1	23.0	1.20	12.0
Hastings	43	−9	22.9	0.45	4.8
Hayes	40	−8	21.4	0.25	2.5

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Michigan—Cont'd.	°	°	°	*Ins.*	*Ins.*
Highland Station	......	......	......	0.70	7.0
Hillsdale	42	− 4	22.7	0.80	7.0
Humboldt	42	−31	11.3	1.05	10.5
Iron Mountain	43	−25	16.3	0.41	7.6
Ironwood	40	−24	15.4	0.57	5.7
Ishpeming	38	−23	14.4	1.60	16.0
Ivan	40	−16	19.6	1.10	15.3
Jackson	40	− 4	23.0	0.65	6.5
Jeddo	38	− 5	21.8	0.51	6.4
Kalamazoo	44	......	......	0.50	4.5
Lake City	35	−16	19.7	0.60	6.0
Lansing	41	− 4	22.4	0.23	4.4
Lapeer	41	− 7	21.6	......	......
Lincoln	47	−12	20.4	0.60	6.0
Ludington	47	− 2	24.8	0.25	2.5
Mackinac Island	40	− 8	20.6	1.30	13.0
Mackinaw	38	− 6	20.1	0.59	6.5
Mancelona	42	− 7	21.8	2.25	22.5
Manistee	42	− 7	22.0	0.90	9.0
Manistique	38	−16	20.8	1.14	11.3
Menominee	38	−21	19.6	0.73	7.5
Midland	41	− 9	23.0	0.55	7.0
Mio	37	−14	19.2	0.76	5.5
Mount Clemens	40	2	21.6	0.45	4.5
Mount Pleasant	39	− 3	23.0	0.60	6.0
Muskegon	41	− 2	24.3	0.35	3.5
Newberry	39	−19	19.2	1.20	12.0
North Marshall	40	− 6	21.4	0.40	4.0
Old Mission	41	− 4	24.0	1.20	12.0
Olivet	39	− 3	22.7	0.51	5.1
Omer	47[c]	− 6	21.8	0.15	1.5
Onaway	36	−13	20.0	1.60	16.0
Ontonagon	39	−18	17.8	3.40	31.0
Ovid	42	− 6	22.0	0.17	1.5
Owosso	42	− 7	22.8	0.15	1.5
Petoskey	38[c]	− 3	22.0[c]	0.85	8.5
Plymouth	48	6	27.2	0.65	6.5
Pontiac	42	− 8	21.7	0.50	5.0
Port Austin	48	− 2	21.4	0.20	2.0
Reed City	35[c]	− 7[c]	20.0[c]	0.30	3.0
Saginaw	41	− 6	23.5	0.36	3.6
St. Ignace	44	−10	21.4	1.54	13.0
St. Johns	40	− 6	23.2	0.25	2.5
St. Joseph	43	6	25.7	0.94	9.4
Somerset*	40	− 8	20.4	0.30	3.0
South Haven	......	2	......	0.61	6.1
Staunton[b]	32	−11	16.2	0.35	3.5
Thornville	40	− 3	22.4	0.65	8.5
Traverse City	40[d]	− 3	23.4	2.00	20.0
Vassar	37	− 5	21.3	0.36	2.2
Wasepi	43	− 5	23.4	0.52	5.0
Waverly	43	− 2	24.2	0.50	5.0
West Branch	40	−11	20.3	0.45	4.5
Wetmore	38	−23	15.6	1.40	14.0
Whitecloud	40	−17	22.2	0.30	3.0
Whitefish Point	37	−10	20.4	1.10	11.0
Ypsilanti	40	− 4	22.5	0.57	5.7
Minnesota.					
Ada	44	−32	9.0	0.06	1.0
Albert Lee	46	−19	16.0	0.59	7.0
Alexandria	45	−26	16.4	0.16	2.0
Ashby	44[c]	−24[c]	14.6[c]	0.26	3.2
Beardsley	56	−28	17.8	0.10	1.0
Bemidji	......	−33	......	0.20	......
Bird Island	51	−20	18.6	0.28	2.8
Blooming Prairie	42	−22	16.1	0.50	5.0
Brainerd	46[d]	−27[d]	12.2[d]	0.69	6.9
Caledonia	44	−24	18.0	0.92	10.0
Collegeville	47	−21	18.2	0.28	2.3
Crookston	57	−30	12.0	0.11	1.1
Currie	55[c]	−23[d]	19.9[c]	......	......
Deephaven	......	......	......	0.76	7.0
Detroit City	45	−37	10.2	0.35	3.5
Faribault	43	−21	18.9	0.30	3.4
Farmington	46	−20	18.2	0.55	5.0
Fergus Falls	45	−26	13.8	0.22	2.2
Glencoe	50	−21	17.5	0.28	2.8
Grand Meadow	42	−21	14.8	0.75	9.6
Hallock	43	−36	9.1	0.10	0.5
Hovland	......	......	......	0.44	6.0
Lakeside	50	−21	18.0	0.30	3.0
Lake Winnibigoshish	43	−34	11.6	0.34	3.4
Leech	43	−30	11.2	0.33	3.2
Long Prairie	45	−30	12.0	0.28	2.2
Luverne	49	−20	18.9	0.57	6.8
Mapleplain	44	−23	17.2	0.62	6.7
Milan	55	−25	17.6	0.35	3.5
Minneapolis *b*[1]	41*	−20	17.6	0.46	4.3
Montevideo	55	−24	16.8	0.42	3.4
Morris	52	−25	16.6	0.20	2.0
Mount Iron	39	−40	10.3	0.20	2.2
New London	50	−23	17.0	0.26	3.0
New Richland	45	−21	19.6	0.65	6.5
New Ulm	50	− 9	20.8	0.80	5.5
Park Rapids	44	−35	11.4	0.48	4.8
Pine River	44	−39	11.0	0.22	5.5
Pipestone	51	−22	18.0	0.12	1.6
Pleasant Mounds	50	−20	20.4	0.23	4.0
Minnesota—Cont'd.	°	°	°	*Ins.*	*Ins.*
Pokegama Falls	49	−50	9.1	0.55	5.3
Redwing *a*	......	......	......	0.46	6.0
Redwing *b*	41	−27	18.6	0.80	8.3
Reeds	......	......	......	0.61	15.0
Rolling Green	46	−17	18.8	0.60	6.0
St. Charles	44	−25	17.3	0.86	6.1
St. Cloud	47	−22	18.2	0.30	3.0
St. Peter	50	−21	21.4	0.39	4.0
Sandy Lake Dam	42	−40	10.6	0.38	5.9
Shakopee	44	−25	18.8	0.58	5.0
Tower	36	−41	10.4	0.70	7.0
Two Harbors	42	−23	13.9	0.64	9.8
Wabasha	43	−30	18.7	0.75	11.0
Warroad	36	−26	8.8	0.10	1.0
Willmar	53	−21	17.0	0.18	2.5
Willow River	44	−40	13.2	0.90	9.7
Winnebago City	49	−20	16.4	0.40	4.0
Winona	43	−28	19.4	0.70	11.0
Worthington	47	−18	19.4	0.53	7.0
Zumbrota[1]	44*	−28	18.1	......	......
Mississippi.					
Aberdeen	60	20	39.2	4.37	
Agricultural College	68	18	41.8	4.07	
Austin	67	16	40.3	6.76	
Batesville	69	15	41.3	5.05	
Bay St. Louis	70	30	50.4	0.93	
Biloxi	70	29	51.3	1.17	
Booneville	63	16	36.6	6.18	
Brookhaven	76	22	46.6	3.45	
Canton	74	21	44.2	3.42	1.2
Cleveland	72	19	43.6	3.37	0.1
Columbus *b*	69	19	41.6	3.45	
Crystalsprings	70	23	44.0	2.88	......
Fayette	75	24	45.2	2.20	T.
Fayette (near)*	75	29	47.0	2.68	0.2
Greenville *a*	68	24	42.4	2.58	1.0
Greenville *b*	75	21	40.9	2.10	0.7
Hattiesburg	71	24	47.1	6.22	
Hazlehurst	74	22	45.6	1.13	T.
Holly Springs	64	17	37.2	4.49	
Indianola	74	21	41.6	3.26	1.0
Jackson	75	20	44.0	3.71	0.5
Lake	70	18	42.0	3.77	1.9
Leakesville	71	22	46.2	3.56	
Louisville	69	16	42.7	3.42	4.5
Magnolia	78	22	47.9	2.63	1.0
Natchez	77	28	46.8	2.40	
Nittayuma	70	23	42.8	3.59	
Okolona	68	15	38.9	3.81	
Palo Alto	71	18	43.6	4.06	
Pearlington	76	25	49.1	1.26	
Pittsboro	69	16	41.5	4.22	3.0
Pontotoc	69	16	40.7	2.75	T.
Poplarville	73	30	52.4	3.29	
Port Gibson	77	22	45.0	2.84	0.5
Ripley	62	19	41.6	4.77	3.0
Shoccoe	......	......	......	5.05	2.5
Stonington*	76	24	45.3	3.20	T.
Suffolk	77	22	47.2	3.20	
Swartwout	73	23	50.2	1.84	
Thornton	70	26	45.9	......	7.0
Tupelo	......	......	......	4.31	......
University	71	14	41.6	4.15	1.6
Walnutgrove	......	20	......	3.69	1.0
Watervalley	70	15	42.4	6.45	T.
Waynesboro	......	22	......	3.95	T.
Woodville	76	27	48.3	2.63	
Yazoo City	75	22	42.4	2.65	3.0
Missouri.					
Appleton City	69	−14	30.1	1.02	9.9
Arthur	66	−15	30.6	0.94	6.5
Avalon	62	−13	29.0	0.78	7.3
Bethany	59	−32	25.4	1.07	10.8
Birchtree	69	1	33.0	0.94	......
Boonville	......	......	......	0.65	7.2
Brunswick	60	−11	27.6	1.40	13.0
Conception	54	−13	26.4	1.30	13.0
Darksville	58	−14	27.2	0.85	8.5
Dean	72	1	33.7	0.75	T.
Desoto	71	− 2	31.8	0.99	2.8
Downing	......	......	......	0.65	6.5
Edgehill*[5]	58	2	29.0	1.30	2.5
Eightmile*[3]	......	−10	27.7	1.40	14.0
Eldon	68	−14	31.0	1.20	12.0
Fairport	......	......	......	1.26	12.6
Fayette	61	− 9	28.8	1.15	10.4
Fulton	62	− 9	29.7	1.40	14.0
Galena	......	......	......	1.61	0.9
Gallatin*[1]	58	−12	27.4	1.70	14.0
Gayoso	67	10	36.0	6.31	T.
Glasgow	61	−11	28.4	0.85	8.5
Gorin	......	......	......	0.80	8.0
Halfway	68	− 4	32.1	1.00	2.5
Harrisonville	63	−12	26.8	1.02	12.3
Hazlehurst	......	......	......	1.25	12.5
Hermann	......	......	......	0.98	10.0
Houston	67	− 1	33.4	0.94	1.0
Irena	......	......	......	0.89	9.5
Missouri—Cont'd.	°	°	°	*Ins.*	*Ins.*
Ironton	71	0	32.5	1.31	2.5
Jackson	65	4	33.6	2.44	0.5
Jefferson City	69	−14	29.6	1.12	9.6
Joplin	68	1	35.8	1.05	1.5
Kidder	53	−16	26.3	1.96	10.7
Koshkonong	70	4	35.2	1.89	1.0
Lamar	68	− 1	33.2	0.69	2.2
Lamonte	......	......	......	0.92	9.0
Lebanon	66	− 3	32.4	1.40	8.0
Lexington	67	− 9	30.4	0.85	7.5
Liberty	61	−11	28.5	0.81	8.1
Louisiana	61	−14	28.6	1.50	4.7
McCune*[1]	61	−14	27.2	1.08	10.8
Macon	61	−13	28.2	0.76	8.5
Marblehill	68	4	32.8	2.40	2.8
Marshall	62	−11	29.0	0.55	5.5
Maryville	57	−12	24.8	1.35	13.5
Mexico	63	− 9	29.6	1.11	11.0
Miami*[5]	56	− 8	28.2	1.02	10.2
Mineralspring	68	0	33.6	0.52	0.8
Monroe City	56	−12	27.4	0.87	7.4
Montreal	69	−10	31.2	1.22	5.5
Mountaingrove	66	− 2	32.6	0.73	2.3
Mount Vernon	70	2	35.0	0.34	T.
Neosho	70	1	33.8	0.88	3.0
Nevada	......	......	......	0.98	8.0
New Haven	66	− 4	31.4	1.10	11.0
New Madrid *b*	......	......	......	5.64	......
New Palestine	64	−10	31.0	0.50	5.0
Oakfield	65	− 5	31.4	0.97	9.0
Olden	69	2	33.9	1.42	T.
Oregon	61	−15	28.0	1.38	12.7
Palmyra*[5]	60	− 8	29.3	0.73	6.8
Phillipsburg*[1]	63	− 4	32.2	0.84	2.2
Pine Hill	......	......	......	1.36	3.7
Poplarbluff	......	8	......	3.77	1.1
Potosi	72	− 4	30.2	1.43	6.0
Princeton	52	−16	25.9	0.96	9.6
Richmond	62	−10	29.0	0.91	8.0
Rockport	......	......	......	1.78	12.0
Rolla	......	......	......	1.31	8.7
St. Charles	65	− 9	31.0	1.16	6.8
St. Joseph	......	......	......	1.10	11.0
Sarcoxie*[3]	......	− 3	28.7	0.28	1.0
Sedalia	62	− 8	30.2	1.20	8.8
Seymour	66	− 4	32.2	1.20	......
Sikeston	69	8	35.5	3.85	1.0
Steffenville	59	−11	27.8	0.95	9.5
Sublett	60	−17	25.6	1.20	10.8
Trenton	52	−14	27.0	1.20	12.0
Unionville	58	−16	26.6	1.07	10.0
Warrensburg	63	− 8	30.2	1.16	11.5
Warrenton	63	− 8	28.8	1.23	10.5
Wheatland	......	......	......	0.65	6.5
Willowsprings	70	0	33.4	1.45	1.0
Windsor	64	−17	29.6	1.47	13.1
Zeitonia	70	0	31.8	0.64	1.1
Montana.					
Adel	52	−37	21.0	0.50	5.0
Augusta	58	−30	23.9	0.14	3.3
Big Timber*	67	−20	23.2	0.05	0.5
Billings	60	−18	24.6	......	......
Boulder	51	−28	19.6	0.05	1.2
Bozeman	53	−28	20.1	0.41	......
Butte	51	−25	21.6	T.	T.
Chester	55	−34	16.6	0.00	
Columbia Falls	53	−21	21.9	1.55	7.5
Crow Agency	56	−21	23.7	0.05	1.5
Culbertson	46	−30	15.1	T.	T.
Dillon	50	−33	20.6	0.99	8.5
Fort Benton	58	−26	22.4	0.40	4.0
Fort Logan	48	−28	18.4	0.00	
Glendive	60	−25	18.5	0.50	5.0
Greatfalls	60	−23	27.6	0.16	1.6
Kipp	57	−30	21.8	0.10	1.0
Lewiston	......	−28	......	0.55	5.5
Livingston	54	−21	27.2	0.04	0.5
Manhattan	53	−35	20.4	0.05	0.5
Marysville	50	−33	18.8	0.25	2.5
Missoula	53	−16	20.8	0.46	2.5
Ovando	49	−45	8.8	0.97	6.7
Parrot	55	−24	22.2	0.04	0.4
Plains	54	−15	23.6	0.35	1.0
Poplar	48	−27	16.0	T.	T.
Ridgelawn	50	−26	18.2	0.11	1.1
St. Pauls	60	−31	22.7	0.25	5.2
St. Peter	54	−37	21.4	0.56	9.0
Springbrook	48	−24	18.0	0.37	3.7
Toston	55	−25	20.0	0.03	0.3
Townsend	55	−32	19.0	0.20	......
Troy	57	−14	25.5	2.17	2.5
Twin Bridges	52	−26	16.6	0.35	3.5
Twodot	54	−38	23.1	0.20	2.0
Utica	60	−26	25.1	0.14	2.0
Yale	55	−24	22.1	0.50	5.0
Nebraska.					
Agate	......	......	......	0.33	3.0
Agee*[1]	52	−22	20.4	0.75	7.5

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Temperature. (Fahrenheit.) Minimum.	Temperature. (Fahrenheit.) Mean.	Precipitation. Rain and melted snow.	Precipitation. Total depth of snow.
	°	°	°	Ins.	Ins.
Nebraska—Cont'd.					
Albion	64	−24	24.8	1.10	11.0
Alliance	60	−22	24.2	0.60	6.0
Alma	67	−22	26.2	0.83	8.3
Ames				0.50	5.0
Ansley	63	−22	24.8	0.52	5.2
Arapahoe				0.40	4.0
Arborville*	58	−12	24.4	0.60	6.0
Arcadia				0.40	4.0
Ashland a	60	−16	26.0	1.31	14.0
Ashland b*	56	−11	24.0		
Ashton				0.20	2.0
Auburn	65	−19	27.4	1.15	11.5
Aurora	63	−15	26.8	0.60	6.0
Bartley				0.70	7.0
Beatrice	62	−23	25.6	1.10	9.0
Beaver	68	−18	28.2	0.60	6.0
Bellevue				0.94	14.1
Benedict				0.60	6.0
Benkleman				0.25	2.5
Blair	56	−15	23.4	0.61	11.0
Bluehill*[5]	55	−15	24.0	0.40	4.0
Bradshaw				0.62	6.2
Bridgeport	63	−24	26.6	0.30	3.0
Brokenbow	63	−25	24.9	0.32	3.2
Burchard				0.90	9.0
Burwell				0.60	6.0
Callaway	64	−23	25.5	0.70	5.5
Central City				0.60	6.0
Chester				1.25	12.5
Cody				0.20	2.0
Columbus	60	−16	25.8	0.65	6.5
Crete	63	−16	25.9	0.79	11.0
Culbertson				0.35	4.0
Curtis	62[e]	−23[e]	28.6[e]	1.00	10.0
Dannebrog				0.65	6.5
David City	59	−16	23.6	0.85	8.0
Dawson	66	−16	29.0	0.84	12.5
Eden				0.95	9.5
Edgar*[5]	62	−10	27.0	0.80	8.0
Ericson				0.60	6.0
Ewing				0.80	8.0
Fairbury	69[f]	−23[f]	25.6[f]	1.14[d]	16.5
Fairmont	63	−16	24.6	0.65	6.5
Fort Robinson	62	−22	23.6	0.69	6.3
Franklin				0.60	6.0
Fremont	56	−25	24.8	0.85	8.5
Fullerton				0.98	10.0
Geneva	62	−16	23.7	0.65	6.5
Genoa	58	−17	24.6	0.60	6.0
Gering	66	−29	26.2	0.15	1.5
Gordon				0.50	5.0
Gosper				0.70	7.0
Gothenburg	60	−22	24.8	0.80	8.0
Grand Island a				0.70	7.0
Grand Island b	66	−19	25.6	0.77	7.6
Grand Island c	63	−15	25.8	0.46	
Greeley				0.45	4.5
Guide Rock				0.80	8.0
Haigler				0.20	2.0
Hartington	53	−17	21.4	1.60	16.0
Harvard	62	−15	25.0	0.70	7.0
Hastings*[1]	60	−11	26.8	0.72	7.2
Hayes Center				0.20	2.0
Hay Springs	62	−25	23.2	0.20	2.0
Hebron	64	−21	26.1	1.27	13.0
Hickman				1.20	12.0
Holbrook				0.83	9.5
Holdrege	61	−8	27.8	0.50	5.0
Hooper*[1]	55	−14	23.9	0.67	8.3
Imperial	61	−19	26.4	0.41	8.0
Johnstown				0.45	4.5
Kearney		−14		0.75	7.5
Kennedy	60[h]	−27[h]	21.4[h]	0.60	6.0
Kimball	59	−25	24.8	0.20	2.0
Kirkwood*[1]	58	−20	20.4	0.60	6.0
Laclede	63	−18	25.4	0.50	5.0
Lexington	60	−21	25.0	1.00	10.0
Lodgepole	62	−22	25.0	0.50	5.0
Loup	66	−39	23.6	0.35	6.0
Lynch	59	−28	22.4	0.50	5.0
Lyons				0.77	10.0
McCook*[1]	57	−12	27.7	0.52	5.2
Madison	59	−20	24.8	0.85	8.0
Madrid	58	−26	24.0	0.50	5.0
Marquette				0.70	7.0
Mason City				0.50	5.0
Minden a	62	−17	25.3	0.64	6.7
Monroe				0.60	6.0
Nebraska City b				1.00	10.0
Nemaha*[1]	64	−14	29.7	1.35	13.5
Nesbit	64	−25	23.6	0.49	11.0
Norfolk	57	−29	22.6	0.91	12.2
North Loup	64	−24	24.8	0.80	8.0
Oakdale	58	−23	22.0	0.46	5.0
Odell				1.00	10.0
O'Neill	60	−23	22.9	0.45	4.5
Osceola				0.60	6.0
Palmer				0.60	6.0
Nebraska—Cont'd.					
Palmyra*[1]	60	−18	23.8	0.90	
Plattsmouth b	58	−17	25.7	1.19	12.5
Ravenna a	66	−20	24.8	0.80	8.0
Redcloud b				0.50	5.0
Republican*[1]	60	−18	27.0	0.35	3.5
Rulo				1.05	10.5
St. Libory				1.00	10.0
St. Paul	63	−22	26.5	0.70	7.0
Salem*	60	−26	26.0	1.30	13.0
Santee	57	−19	23.6	0.73	9.9
Schuyler				1.10	11.0
Seneca*[1]	58	−20	22.2	0.50	5.0
Seward	60	−18	24.2	0.90	9.0
Smithfield				0.60	6.0
Spragg				0.40	4.0
Stanton	58	−24	23.6	0.55	9.0
State Farm	60	−18	26.0	0.95	14.0
Strang*	62	−11	28.2	0.70	7.0
Stratton				0.31	
Superior	66	−22	24.1	0.90	9.0
Syracuse				1.20	12.0
Tablerock				0.90	9.0
Tecumseh b	64	−23	24.8	0.90	9.0
Tecumseh c				0.79	8.2
Tekamah	59	−24	25.1	1.15	13.8
Turlington	60	−15	26.7	1.45	14.5
Wakefield	56	−35	22.4	1.42	14.2
Wallace				0.42	4.2
Weeping Water				1.34	16.5
Westpoint	62	−25	27.0	0.69	12.2
Wilber*[1]	66	−18	23.8	1.00	10.0
Willard				0.94	3.5
Winnebago				0.69	14.0
Wisner				0.71	11.0
Wymore				1.20	12.0
York	65	−18	25.9	0.65	6.5
Nevada.					
Amos	57	−23	26.2	0.43	2.0
Austin	53	−13	27.2	0.43	
Battle Mountain				0.40	4.0
Belmont				0.18	3.0
Beowawe*[1]	55	−12	31.8	0.15	1.5
Candelaria	69	−1	36.8	0.05	0.5
Carson City	64	−3	31.4	0.38	4.2
Cranes Ranch				0.43	
Elko*[1]	50	−17	23.0	0.40	4.0
Elko (near)	51	−27	22.6	0.80	8.0
Ely	58	−24	25.8	0.91	8.0
Fenelon*[1]	65	−20	25.5	0.95	9.5
Golconda*[1]	57	−4	31.2	0.20	2.0
Halleck*[1]	55	−27	24.1	0.32	3.2
Hamilton	52	−13	28.8	1.57	15.9
Hot Springs*[5]	62	−3	32.6	T.	T.
Humboldt	55	−4	30.4	0.20	2.0
Lee				0.89	9.5
Lewers Ranch	62	−14	32.8	1.13	8.0
Lovelocks b	58	−10	30.2	0.10	1.0
Martins	68	−9	32.5	0.35	3.5
Mill City*[1]	57	−5	30.2	0.14	1.5
Monitor Mill	60			0.50	5.5
Owyhee	53	−21	26.1	0.57	6.9
Palisade*[1]	50	−15	32.4	0.57	5.7
Palmetto	61	−14	29.2	0.20	2.0
Potts	56	−32	25.2	0.54	12.0
Reno State University	62	−1	30.1	0.15	1.5
Silverpeak*	55	0	30.0	T.	T.
Sodaville	60	0	31.6	T.	T.
Tecoma*[1]	55	−10	25.7	0.35	3.5
Toano*[5]	47	−13	22.6	0.08	T.
Tybo	50	−7	29.4	0.60	6.0
Verdi*[5]	58	−4	30.0	1.00	10.0
Wadsworth	62	−11	30.0	0.55	5.5
Wells*[1]	49	−12	23.4	0.60	2.0
Wood	49	−17	23.2	0.38	3.0
New Hampshire.					
Alstead	48	−6	20.2	2.88	14.2
Berlin Mills	42	−20	12.4	3.21	13.0
Bethlehem	44	−10	15.5	1.18	6.0
Brookline*[1]	46	−10	21.9	2.65	11.5
Chatham	44	−13	16.0	5.88	13.0
Concord	44	−8	19.4	2.54	12.8
Durham	50	−5	21.8	2.77	15.2
Franklin Falls	43	−5	18.7	2.81	10.5
Grafton	43	−19	16.7[g]	3.48	12.0
Hanover	45	−14	16.0	1.56	9.3
Keene	46	−16	19.6	1.99	11.2
Littleton	45	−12	12.7	1.91	4.1
Nashua	51	−5	21.2	2.15	12.5
Newton	50	−6	21.8	1.99	11.5
Peterboro	46	−17	18.2	2.74	4.8
Plymouth	44	−9	17.0	2.27	13.0
Sanbornton	44	−5	18.0	2.49	9.0
Stratford	43	−15	13.8	1.08	6.0
New Jersey.					
Asbury Park	53	11	30.2	2.52	9.0
Bayonne	48	11	28.3	2.87	10.4
Belvidere	51	5	25.8	3.13	8.2
Bergen Point	49	11	28.0	3.45	13.0
New Jersey—Cont'd.					
Beverly	53	9	29.8	2.82	9.2
Blairstown	52	5	24.8	3.41	7.5
Bridgeton	53	10	31.4	3.95	6.0
Camden	54	13	31.0	3.46	6.4
Cape May C. H.	53	8	31.0	3.12	7.6
Charlotteburg	48	2	24.8	4.35	8.5
Chester	47	6	24.6	3.84	9.5
Clayton	53	9	29.6	3.81	12.0
College Farm	50	11	28.4	2.70	8.2
Dover	47	4	23.7	4.31	8.5
Egg Harbor City	52	8	29.5	3.52	9.0
Elizabeth	47	11	29.3	3.74	12.2
Flemington	58	8	28.4	3.13	8.4
Freehold	51	10	28.7	3.36	10.1
Friesburg				3.21	7.0
Hanover	51	0	25.3	3.88	10.5
Hightstown	50	12	29.2	3.53	10.0
Imlaystown	51	12	29.0	2.93	5.7
Indian Mills	53	6	30.1	2.89	4.5
Lakewood	53	9	29.6	2.91	9.0
Lambertville	53	8	28.8	2.60	7.5
Layton	48	−5	23.0	2.96	7.2
Moorestown	53	11	29.8	2.95	5.6
Mount Pleasant				2.38	7.6
Newark	50	10	27.2	2.77	8.8
New Brunswick	49	11	28.7	3.18	10.7
New Egypt				2.48	
Newton	50	2	25.3	3.55	10.0
Oceanic	51	12	29.4	2.79	10.2
Paterson	51	12	29.8	3.91	12.0
Plainfield	49	10	27.4	3.24	8.0
Ringwood	49	−3	25.3	4.06	7.5
Rivervale	52			4.07	10.0
Roseland	51	4	25.4	3.40	9.8
Salem	53	13	30.8	3.15	6.0
Somerville	49	8	28.1	2.94	7.0
South Orange	49	10	27.0	3.01	9.8
Sussex	49	0	25.2	3.23	8.0
Three Bridges				3.54	11.5
Trenton	50	15	31.4	3.36	8.0
Tuckerton	57	8	29.8	3.70	11.0
Vineland	52	10	50.4	3.81	7.8
Woodbine	53	6	30.2	3.73	8.0
Woodstown				3.21	5.0
New Mexico.					
Alamagordo	78	20	43.8	T.	
Albert	70	1	38.8	0.08	0.5
Albuquerque	62	14	37.4	0.32	3.2
Alma	79	10	38.8	0.62	
Arabela		10		1.05	12.0
Aztec	60	7[j]	28.0[e]	0.76	
Bellranch				0.22	2.2
Bluewater	57	−12	25.0	1.35	10.5
Cambray				0.00	
Carlsbad	81	13	45.8	0.30	3.0
Cloudcroft	47	−2	28.1	1.23	12.3
Deming				T.	T.
East Lasvegas	54	13	33.9	0.20	2.0
Engle	64	17	40.2	0.00	
Folsom	58	−7	28.2	0.35	4.5
Fort Stanton	63[e]	7[e]	36.6[e]	0.05	0.5
Fort Union	70	3	34.9	0.07	1.0
Gage				0.00	
Galisteo	68	8	32.0	0.20	2.0
Gallinas Spring	65	6	36.0	0.15	1.5
Horse Springs	59	11	33.5	1.35	4.3
Las Vegas	64	5	33.2	0.10	1.0
Las Vegas Hotsprings	62	2	34.8	T.	T.
Lordsburg				T.	T.
Lower Penasco	72	13	46.1	0.80	
Mesilla Park	68	14	43.0	0.02	T.
Raton	59	−2	31.8	0.25	2.5
Roswell	71	10	39.7	1.24	5.5
San Marcial	66	18	41.4	T.	T.
Socorro	67	19	39.4	0.66	0.8
Strauss				0.04	
Taos	52	−10	26.9	0.50	5.0
Winsors Ranch		−7		1.30	13.0
Woodbury	59	9	35.2	0.65	6.5
New York.					
Adams				3.80	33.0
Addison	46	−8	22.6	2.30	15.0
Adirondack Lodge	40	−14	15.2	1.80	13.5
Alden	43	−5	22.8	2.57	25.7
Angelica	49	−11	19.8	2.80	28.5
Appleton	47	1	24.2	2.80	
Athens				0.97	4.5
Atlanta	43	−9	19.9	2.83	14.5
Auburn	40	2	23.2	0.94	11.5
Avon	42	0	22.2	1.33	12.0
Axton	38	−23	12.4	1.68	16.5
Baldwinsville	40	0	21.4	2.51	22.0
Bedford a	48	6	29.6	2.50	6.8
Bolivar	40	−15	19.1	2.27	25.3
Bouckville	49	−6	19.6	1.88	17.5
Boyds Corners				2.77	
Brockport	43	0	22.4	3.11	27.0
Caldwell	42	−10	17.7	2.45	16.0

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	Ins.	Ins.
New York—Cont'd.					
Canaan Four Corners	45	−7	20.5	1.14	7.5
Canajoharie	48	−5	19.8	1.37	6.8
Canton	41	−27	13.6	2.24	12.0
Carmel	47	0	23.6	2.92	5.8
Carvers Falls	42	−18	14.6	0.81	8.0
Catskill	48	1	24.1	3.36	8.0
Cedarhill	47	−2	22.0	0.68	1.2
Cooperstown	40	−5	19.0	1.04	6.5
Cortland	42	−2	24.4	1.25	6.0
Cutchogue	48	9	28.4	2.11	5.5
Dekalb Junction				1.76	16.5
Easton				2.35	7.0
Elba	40	−2	20.6	3.40	34.0
Elmira	41	−2	23.7	1.93	2.3
Fayetteville	44	−2	21.9	1.09	10.0
Franklinville	51	−12	18.6	2.39	20.9
Gabriels	37	−14	12.8	1.52	13.0
Gansevoort				1.85	9.0
Glens Falls	43	−4	19.4	1.56	11.5
Gloversville	42	−10	17.6	1.85	13.1
Greenwich	48[c]	−10[c]	19.1[c]	1.29	7.0
Griffin Corners	44	−8	19.5	1.83	7.0
Haskinville				1.50	13.7
Hemlock	42	0	22.5	1.41	17.0
Honeymead Brook	48	−9	21.9	2.55	3.4
Humphrey	40	−5	18.6	2.69	24.9
Indian Lake	40	−22	13.8	2.01	16.3
Ithaca	43	−2	22.0	1.36	8.9
Jamestown	43	−6	22.6	2.34	20.6
Keene Valley	42	−12	15.5	2.65	20.9
King Ferry				1.40	11.4
Littlefalls, City Res	45	−8	19.0	1.27	10.0
Lockport	42	0	25.8		30.1
Lowville	39	−16	16.0	1.90	14.0
Lyndonville				3.39	
Lyons	43	3	24.9	1.82	15.5
Mayle				4.57	45.0
Meredith	40	−10	16.8	3.47	21.4
Middletown	45	5	24.2	1.75	8.0
Mohonk Lake	45	−1	22.2	3.44	9.5
Moira	45	−14	15.1	2.89	21.0
Newark Valley				1.54	8.5
New Lisbon	42	−12	16.8	1.00	5.5
North Hammond				2.01	23.8
Number Four	43	−15	14.6	3.33	32.3
Nunda	44	−2	23.2	2.93	17.5
Ogdensburg	40	−12	16.7	1.13	10.4
Old Chatham				1.88	4.0
Oneonta	43	−4	20.3	1.09	7.0
Oxford	43	−9	19.3	1.82	11.8
Palermo				2.83	20.8
Penn Yan	44	1	22.8	1.44	4.4
Perry City	38	−8	19.8	2.18	12.7
Plattsburg Barracks	46	−10	17.8	0.90	7.0
Port Byron	40	3	22.2	2.00	16.0
Port Jervis	51	0	23.5	3.09	7.0
Primrose	49	9	26.6	3.12	14.0
Redhook				1.83	
Richmondville	43	−1	20.0	1.38	4.5
Ridgeway	42	1	23.4	3.09	30.0
Rome	44	−8	20.9	0.54	5.0
Romulus	40	3	22.8	3.31	10.5
Salisbury Mills				3.18	
Saranac Lake	42	−14	13.9	1.22	18.4
Saratoga Springs	44	−10	16.8	1.62	4.5
Setauket	51	9	28.8	1.95	5.5
Shortsville	44	2	22.9	1.40	9.0
Skaneateles				1.63	
Southampton	49	10	29.1	1.15	5.5
South Canisteo	45	6	21.7	2.90	26.0
Southeast Reservoir				3.12	
South Kortright	46	−7	19.8	1.61	8.6
South Schroon	39	−15	15.6	2.25	16.6
Straits Corners	42[c]	−10[d]	18.6[d]	2.85	17.5
Ticonderoga	49	−7	20.2	1.37	16.5
Volusia	40	−3	21.8	2.79	
Walton	47	−6	20.7	1.87	8.2
Wappingers Falls	50	−4	24.8	3.32	9.0
Warwick				2.07	
Watertown	41	−18	19.7	2.41	22.0
Waverly	42	−9	21.2	2.48	12.7
Wedgwood	40	−2	19.9	2.04	14.5
Wells	42	−20	16.9	2.46	16.4
West Berne	39	−8	21.2	0.75	3.0
West Chazy	40	−13	14.6		
Westfield *b*	40	0	23.9	1.95	
Westfield *c*	44	3	26.0	1.22	16.0
Windham	45	−8	20.2	0.87	7.0
Wolcott				2.74	14.2
North Carolina.					
Absher	69	9	36.8	2.37	T.
Asheville				1.63	4.3
Bryson City				3.95	2.3
Chapelhill	68	14	37.6	2.30	
Cherryville				2.20	
Currituck				2.58	T.
Edenton	68	19	39.8	2.60	
Fayetteville	71	15	40.6	2.20	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	Ins.	Ins.
North Carolina—Cont'd.					
Goldsboro	75	17	41.3	2.31	
Greensboro	66	16	36.2	2.17	
Henderson	65	15	36.4	1.10	T.
Hendersonville	68	8	37.0	2.15	3.2
Henrietta	69	14	38.6	1.97	T.
Highlands	58	7	33.8	4.47	10.5
Horse Cove	65	12	37.4	3.80	4.1
Hot Springs	72	15	41.2		
Kinston	73	15	41.3	1.01	
Lenoir	68	10	37.0	2.80	T.
Linville	53	5	31.0	1.71	4.5
Littleton	70	13	36.0	2.59	T.
Louisburg	66	13	37.2	2.80	T.
Lumberton	68	18	39.4	2.15	
Marion	69	12	37.4	2.37	3.8
Marshall	59	11	35.5	1.35	4.5
Mocksville	59	8	35.0	1.66	T.
Moncure	75	15	38.9	2.65	
Monroe	68	9	37.5	3.12	
Morganton	66	10	37.6	1.96	2.5
Mountairy	59	10	34.8	2.96	1.5
Murphy				6.87	4.0
Newbern	71	18	44.4	2.09	
Oakridge	70	13	38.6	1.86	
Patterson*	64	13	32.8	1.73	1.5
Penelo	66	14	39.5	2.66	
Pittsboro	55	10	33.5	1.28	
Reidsville	64	15	36.2	2.07	T.
Rockingham	67	14	39.0	3.31	
Roxboro	64	14	35.9	1.85	
Salem	66	10	35.2	2.15	T.
Salisbury	61	15	38.4	2.17	
Saxon	65	10	35.2	2.37	0.5
Selma	65	13	37.8	3.80	
Settle	65	6	36.7	2.42	T.
Sloan	75	16	41.6	3.51	
Soapstone Mount	66	9	35.6	2.11	T.
Southern Pines *a*	70	15	41.7	3.38	
Southern Pines *b*	67	16	40.0	3.25	
Southport	64	20	44.4	1.72	
Springhope*[1]	70	15	38.8	2.35	T.
Statesville	69	9	36.0	2.54	
Tarboro	67[c]	14[c]	39.1[c]	2.85	
Washington	71	18	43.6	3.46	
Waynesville	65	9	37.2	2.12	1.8
Weldon *a*	63	17	36.4	2.38	
Weldon *b*				2.53	
North Dakota.					
Amenia	45	−29	11.9	0.25	2.5
Ashley	40	−30	9.8	T.	T.
Berlin	46	−35	11.8	0.29	2.9
Bottineau				0.00	
Buxton	48	−32	13.7	0.05	0.5
Cando	42	−40	10.1	T.	T.
Churchs Ferry	43	−32	11.4	0.10	1.0
Coalharbor	45	−15	17.4	T.	T.
Devils Lake	49	−32	13.2	T.	T.
Dickinson	42	−29	14.6	0.18	1.5
Donnybrook				0.15	1.5
Dunseith	40	−39	8.6	T.	T.
Edgeley	47	−26	15.9	0.21	2.0
Ellendale	48	−26	15.5	0.20	2.0
Falconer[j]	42	−26	9.6	T.	T.
Fargo	41			0.18	1.8
Forman	45	−29	14.8	0.13	3.0
Fort Yates	51	−26	16.8	0.18	1.8
Fullerton	45	−31	13.8	0.24	2.4
Gallatin	46	−32	12.8	0.09	0.9
Glenullin	45	−21	17.1	T.	T.
Grafton	46	−31	12.9	0.50	5.0
Hamilton	45	−33	11.8	0.16	1.6
Hannaford	44	−30	13.2	0.06	0.6
Jamestown	44	−28	12.5	0.10	1.0
Larimore	47	−34	11.9	0.10	1.0
McKinney	45	−30	12.8	0.05	0.5
Mayville	47	−30	11.4	0.15	1.5
Medora	50	−30	17.0	0.10	1.0
Melville	46	−28	14.6	T.	T.
Milton	49	−36	8.1	0.01	0.1
Minot	46	−23	19.6	T.	T.
Minto	47	−34	11.4	0.08	0.8
Napoleon	44	−26	10.9	0.04	1.0
New England	44	−27	14.0	T.	T.
Oakdale	50	−21	19.6	0.40	4.0
Pembina	43	−34	9.4	0.12	1.0
Portal	41	−33	12.0	0.80	8.0
Power	49	−26	13.0	0.35	3.5
Steele	39	−30	11.4	T.	T.
University	46	−33	13.6	0.31	3.1
Valley City	38	−31	5.8	0.22	2.2
Wahpeton	47	−24	17.5	0.10	1.0
Willow City	45	−34	10.4	T.	T.
Woodbridge	41	−36	11.0	0.10	1.0
Ohio.					
Akron	46	2	25.6	1.10	11.0
Annapolis	45	3	26.2	0.41	2.5
Atwater				1.40	14.0
Bangorville	51	−1	25.6	0.86	5.2

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	Ins.	Ins.
Ohio—Cont'd.					
Bellefontaine	50	2	27.4	1.00	4.0
Bement				0.48	3.5
Benton Ridge	50	0	26.8	0.81	7.5
Bethany	56	0	30.6	1.53	4.0
Binola				2.51	23.0
Bladensburg	50	2	25.1	1.02	6.0
Bloomingburg	50	4	28.8		
Bowling Green	46	−1	25.6	0.55	5.2
Cambridge	59	5	27.8	1.69	1.0
Camp Dennison	57	7	29.8	2.41	11.5
Canaan				1.84	11.5
Canal Dover	47	4	27.1	1.33	5.0
Canton	47	3	26.8	1.08	7.3
Cardington	49	1	26.4	0.64	4.1
Cedarville				1.33	5.8
Celina	54	−5	25.7	0.62	4.0
Circleville	53	6	29.6	1.78	4.0
Clarksville	56	4	30.1	2.08	5.3
Cleveland *a*	47	4	27.3	1.33	11.6
Cleveland *b*	47	3	26.0	0.93	8.6
Clifton	52	3	28.8	1.34	5.0
Coalton	60	3	29.3	2.91	10.0
Colebrook	40[c]	−2[c]	24.8	2.51	22.2
Dayton *a*				1.49	4.8
Dayton *b*	53	0	28.9	1.13	6.6
Defiance	50	−2	26.2	0.49	4.7
Delaware	56	3	27.3	0.92	5.7
Demos	47	4	27.2	1.70	6.0
Dunham				2.50	4.0
Elyria	50	2	25.0	0.93	9.2
Findlay	52	0	27.9	0.40	5.0
Frankfort	53	5	29.2	2.08	4.0
Fremont	47	1	26.8	0.40	6.1
Garrettsville	47	−5	24.4	1.59	16.7
Granville	53	4	27.3	1.09	7.3
Gratiot	50	4	27.1	1.62	8.2
Green	57	6	31.2	3.95	9.0
Greenfield	57	8	30.8	1.20	8.0
Greenhill	46	3	24.7	1.05	7.0
Greenville	57	1	29.2	0.96	5.8
Hanging Rock	60	9	31.1	4.75	
Hedges	49	−2	26.0	0.59	4.0
Hillhouse	45	−5	23.2	2.04	17.0
Hillsboro	52	6	28.6	2.80	
Hiram	45	−3	23.9	1.76	18.0
Hudson	45	−3	24.0	3.00	30.0
Jacksonboro	53	3	29.0	1.85	11.0
Killbuck	48	2	25.8	1.35	10.5
Lancaster	52	5	28.4	1.80	7.5
Lima	51	0	27.8	0.28	T.
McConnellsville	55	6	28.4	2.01	7.8
Manara	52	5	28.1	1.64	7.0
Mansfield				1.52	8.5
Marietta	55	10	30.6	2.52	5.5
Marion	49	1	28.0	0.60	1.6
Medina	46	−6	25.2	2.50	22.0
Milfordton	56	−3	24.3	0.75	7.0
Milligan	50	5	27.6	1.67	6.0
Millport	48	0	24.8	1.11	9.4
Montpelier	44	−2	24.5	0.89	7.0
Moorefield	50	5	28.1	1.96	7.0
Napoleon	49	0	27.2	0.35	3.5
New Alexandria	48	4	27.7	0.90	7.0
New Berlin	47	2	26.4	1.20	6.5
New Bremen	56	−1	26.8	0.87	8.0
New Lexington				1.45	3.5
New Paris	56	0	28.3	0.90	5.0
New Richmond	60	6	31.7	3.08	9.9
New Waterford	46	3	26.0	3.05	22.0
North Lewisburg	52	0	26.7	1.65	14.0
North Royalton	45	−1	25.4	3.20	32.0
Norwalk	47	1	26.8	0.84	7.5
Oberlin	49	0	26.5	1.36	12.4
Ohio State University	53	4	27.6	1.41	9.2
Ottawa	51	0	26.4	0.43	T.
Pataskala	53	3	26.9	1.80	11.7
Philo	52	7	28.6	1.36	6.8
Plattsburg	51	1	27.0	1.11	6.0
Pomeroy	62	10	30.2	2.44	7.0
Portsmouth *a*				3.72	7.0
Portsmouth *b*	63	10	32.5	3.15	7.5
Pulse				3.17	
Red Lion				1.10	
Richfield				1.41	14.1
Richwood	55	2	27.5	1.14	10.7
Ripley	56	8	30.1	2.47	11.9
Rittman	48	1	26.2	0.85	9.3
Rockyridge	47	−2	25.8	0.47	5.0
Shenandoah	46	0	24.2	0.89	5.4
Sidney	56	0	27.4	0.99	6.9
Somerset	52	5	29.2	1.19	5.7
Springfield				1.02	
Strongsville				1.44	11.0
Swanton				0.42	4.2
Thurman	61	8	31.0	5.03	
Tiffin	47	2	27.0	0.93	7.8
Upper Sandusky	50	1	27.6	1.55	15.5
Urbana	51	3	27.3	0.86	6.4

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
Ohio—Cont'd.					
Vanwert	48	1	25.9	0.61	6.5
Vickery	47	0	26.0	0.51	4.5
Walnut				1.52	5.1
Warren	47	3	24.6	2.31	15.2
Warsaw	49	3	26.0	1.04	
Wauseon	46	−3	24.9	0.71	8.0
Waverly	60	8	30.4	2.91	7.2
Waynesville	52	4	28.0	1.55	7.0
Wellington	49	0	26.0	1.51	13.5
Westerville	53e	3e	25.8e		
Willoughby				1.55	7.0
Wooster	47	2	26.2	0.63	6.2
Zanesville				1.77	6.0
Oklahoma.					
Arapaho	74	−2	37.8	0.40	2.6
Beaver	70	−6	36.8	0.50	5.0
Blackburn	72	−4	34.8	1.67	6.5
Burnett	72	5	37.2	0.07	T.
Clifton	74	4	36.8	0.55	3.1
Cloud Chief	72	0	35.4	0.15	0.7
Fort Reno	72	−10	34.5	0.15	0.3
Fort Sill	68	4	39.2	0.02	0.2
Guthrie	69	−1	38.4	0.07	0.7
Hennessey	75	0	38.8	0.35	2.0
Jefferson	73	−6	34.5	0.25	2.5
Jenkins	73	−4	35.0	0.40	2.5
Kenton	74	−7	35.2	0.30	3.0
Kingfisher	75	0	36.6	0.17	0.5
Lyons	71	−3[i]	34.2e	0.21	0.9
Mangum	70	3	39.7	0.10	1.0
Newkirk	64	−1	31.8	0.95	
Norman	70	1	35.8	0.31	0.5
Pawhuska	68	−2	34.0	0.67	2.7
Perry	73	−4	35.6	0.23	0.8
Shawnee	72	4	38.2	0.84	
Stillwater	71			0.13	0.5
Taloga	73	−1	35.4	0.05	0.5
Waukomis	74	0	36.6	0.40	1.5
Weatherford	69	−2	38.4	0.38	1.4
Woodward	72	−6	38.2	0.15	1.5
Oregon.					
Albany *a**[1]	58	17	38.9	1.81	2.5
Albany *b*				4.30	T.
Alpha	59	16	38.6	7.40	0.5
Arlington	66	−2		0.93	6.0
Ashland *b*	65	12	37.9	0.35	1.0
Aurora*[1]	60	18	39.4	2.56	4.0
Aurora (near)	58	10	37.2	3.60	5.0
Bay City	63	18	42.4	7.51	0.5
Bend	54e	−19e	28.2e	0.63	
Beulah	48	−16	24.0	0.64	5.0
Blackbutte	60	13	40.4	3.18	4.0
Blalock	65	−2	32.4	1.00	5.5
Brownsville*[4]	60	20	42.8		
Burns	51	−20	26.2	0.72	10.5
Cascade Locks	59	7	37.6	7.80	10.0
Comstock*[1]	57	18	41.0	3.16	1.0
Coquille				4.72	
Corvallis	58	11	37.7	4.25	3.8
Dayville	64	−3	33.3	0.46	4.2
Detroit	50	5	35.2	6.97	10.0
Ella				1.77	7.0
Eugene	60	14	38.6	3.43	3.5
Fairview	58	19	40.9	5.38	1.0
Falls City	55	13	36.9	8.64	1.7
Forestgrove	57	7	38.4	5.19	4.5
Gardiner	60	23	43.2	7.15	T.
Glenora	58	12	36.8	12.69	7.0
Government Camp	54	−11	29.5	5.54	28.0
Grants Pass	57	16	37.8	2.22	1.3
Hare	68	21	44.0	8.01	0.5
Heppner	65	−16	31.0	0.93	6.0
Hood River (near)	58	−3	32.8	3.81	11.5
Huntington	69	−9	29.4	0.89	10.0
Jacksonville	58	14	37.1	1.16	1.3
Joseph	55	−21	22.9	1.45	14.5
Kerby	58	17	38.8	4.98	1.5
Klamath Falls	54	−5	30.2	T.	T.
Lafayette*[1]	56	18	39.7	3.86	3.0
Lagrande	55	−10	30.6	0.79	8.0
Lakeview	58	−13	29.6	0.83	10.5
Lonerock	60	−16	30.6	1.26	7.0
McMinnville	57	6	38.4	5.09	2.0
Merlin*[1]	68	18	38.8	2.14	2.2
Monmouth *a*	57	16	38.7	3.85	1.5
Monroe	58	14	37.5	4.89	0.7
Nehalem				7.25	
Newberg	57	9	37.6	4.42	1.4
Newport	63	17	44.2	7.78	1.0
Pendleton	68	−5	32.2	1.32	9.0
Pine	47	−27	20.6	1.45	13.0
Placer				3.61	6.0
Riddles*[1]	58	23	41.3	1.46	5.0
Riverside	49e	−17e	24.4e	0.65	6.0
Salem *b*	62	12	38.8	1.48	1.0
Sheridan*[1]	57	17	40.6	3.43	4.0
Silverlake	58	−22	29.1	0.24	2.4
Silverton*[1]	60	10	37.8	3.39	2.5

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
Oregon—Cont'd.					
Siskiyou*[1]	53	15	37.4	1.80	10.0
Smock	59	−10	28.9	1.85	15.0
Sparta	47	−14	24.6	2.53	25.0
Springfield*[1]	60	16	39.4	3.66	1.2
Stafford	58	10	36.8	4.06	5.0
The Dalles	57	−2	32.8	1.61	9.2
Toledo	66	15	43.0	7.13	1.7
Umatilla				1.22	5.2
Vale	52	−14	24.6	0.50	4.5
Westfork*	59	24	42.5	2.62	
Weston	61	−15	26.4	1.78	18.5
Williams	61	15	39.2	2.28	1.3
Pennsylvania.					
Aleppo	49	−6	27.8	2.57	
Altoona	49	4	25.5	2.85	
Athens	43	−6	21.6	2.05	7.0
Bellefonte	46	7	27.2	2.70	15.0
Brookville				3.04	17.0
Browers Lock				3.55	
California	51	7	29.5	2.03	9.5
Cassandra	47	2	24.5	3.14	28.0
Centerhall	46	0	20.8	1.50	7.5
Clarion				1.88	14.3
Coatesville	50	11	28.8	3.64	7.1
Confluence				2.80	13.6
Davis Island Dam				1.00	
Derry Station	50	11	28.4	4.18	20.5
Driftwood				2.18	3.0
Duncannon				3.13	8.7
Dushore	43	−7	20.7	2.58	8.0
Dyberry	42	−13	18.3	2.34	7.9
East Bloomsburg				2.37	10.8
East Mauch Chunk	49	7	24.9	4.54	9.2
Easton	48	10	26.6	2.49	7.3
Ellwood Junction				1.46	5.5
Emporium	45	−2	24.0	2.27	16.6
Ephrata	48	11	27.4	3.25	8.6
Everett	51e	6e	26.1e	4.10	13.5
Forks of Neshaminy*[1]	45	11	27.0	2.64	6.5
Franklin	47	−5	24.4	2.16	21.4
Freeport				1.96	10.7
Girardville				4.22	17.2
Grampian	44	0	22.8	2.42	25.0
Greensboro				2.26	10.0
Hamburg				4.09	11.0
Hamlinton	43	1	20.0	2.94	11.2
Hawthorn	46	−5	25.4	2.58	18.0
Herrs Island Dam				1.48	7.5
Huntingdon *a*	49	8	27.8	2.44	10.5
Huntingdon *b*				1.76	13.0
Irwin				2.08	
Johnstown	54	7	28.6	3.47	16.0
Kennett Square	49	10	30.2	3.77	6.5
Lancaster	47	6	26.8	2.65	4.8
Lawrenceville	42	−11	20.8	1.75	
Lebanon	48	12	27.4	3.62	10.3
Leroy	39	−3	21.0	2.59	6.6
Lewisburg	45	8	25.5	3.53	11.0
Lockhaven *a*	45	4	26.3	2.76	13.0
Lockhaven *b*				2.57	14.2
Lock No. 4				2.19	14.0
Lycippus	50	3	25.4	3.83	20.4
Mifflin				3.65	10.0
Oil City				1.88	14.1
Parker				2.26	11.2
Philadelphia	53	16	31.7	2.95	7.3
Pocono Lake	44	−5	20.0	2.07	7.3
Pottstown	50	13	31.6	3.71	8.9
Quakertown	52	5	27.8	3.26	9.0
Reading[2]			26.7	3.45	
Renovo *a*				2.23	
Saegerstown	43	−10	22.6	2.43	22.2
St. Marys	41	−3	21.2	2.62	26.2
Saltsburg				2.62	10.0
Selinsgrove	50	9	27.4	3.28	10.5
Shawmont				2.09	
Smethport	43	−9	21.0		
Somerset	38	−5	19.4	5.15	38.8
South Eaton	45	−1	24.0	1.42	5.0
State College	4"	4	24.6	3.02	10.2
Sunbury				2.30	4.0
Swathmore	49	13	28.4	3.05	6.0
Towanda	48	−7	21.9	1.72	5.8
Troutrun				5.47	11.5
Uniontown	55	10	30.8	2.57	13.0
Warren	42	−3	23.4	1.26	12.2
Wellsboro	43	−5	23.4	1.54	7.5
Westchester	50	12	28.5	4.06	6.5
West Newton				2.67	18.0
Westtown	58	9	28.0	4.08	5.5
Wilkesbarre	48	6	25.8	2.23	6.0
Williamsport	45	6	24.6	3.61	9.5
York	49	11	28.6	2.73	10.2
Rhode Island.					
Bristol	49	8	27.9	1.64	4.0
Kingston	48	−1	24.8	2.62	5.5
Pawtucket	52	10	27.3	2.02	5.0
Providence *a*	53	7	27.8	2.06	5.5

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
Rhode Island—Cont'd.					
Providence *c*	51	4	26.0	2.08	4.5
South Carolina.					
Aiken	73	17	44.3	1.35	
Anderson	69	18	42.2	3.40	
Barksdale	79	17	41.2	3.41	
Batesburg	70	23	42.8	2.82	
Beaufort	74	25	49.4	0.77	
Blackville	76	18	44.2	0.36	
Bowman	77	16	45.6	0.88	
Calhoun Falls				3.49	
Camden				1.97	
Cheraw *a*	71	16	39.7	2.73	
Cheraw *b*				2.87	
Clemson College	68	13	38.4	4.14	
Conway	80	18	43.0	1.16	
Darlington	76	15	41.5	2.21	
Duewest	66	19	41.0	3.07	
Edisto				1.12	
Effingham				0.97	
Florence	73	20	40.8	1.30	
Gaffney	70	15	37.9	2.67	
Georgetown	76	22	49.1	1.90	
Gillisonville	80	18	47.2	0.74	
Greenville	67	12	36.8	3.02	T.
Greenwood	67	17	39.6	3.05	
Heath Springs	62	24	40.6	3.27	
Kingstree *b*				1.39	
Liberty	68	13	40.0	3.24	T.
Little Mountain	68	17	41.8	2.33	
Longshore	69	17	40.6	4.18	
Lugoff	73	15	41.4	1.95	
St. Stephens				1.65	
Santuck	70	13	38.8	3.32	
Seivern	75	12	43.2	1.27	
Smiths Mills				1.76	
Society Hill	69	19	41.0	2.47	
Spartanburg	68	15	37.7	3.06	T.
Statesburg	74	20	44.4	1.23	
Summerville	78	19	46.8	1.24	
Sumter	75	19	44.2	0.60	
Temperance	76	11	42.0	2.05	
Trenton	68	16	42.6	1.40	
Trial	70	15	44.2	1.35	
Walhalla	69	13	38.4	3.65	
Winnsboro	70	18	40.8	3.02	
Winthrop College	68	18	39.8	3.64	
Yorkville	70	15	41.2	3.50	
South Dakota.					
Aberdeen	53	−31	15.0		
Academy	58	−20	23.9	0.41	4.3
Alexandria	54	−22	21.3	0.32	3.0
Armour	58	−20	21.4	0.60	6.0
Ashcroft	60	−29	21.7	0.35	3.5
Bad Nation	62	−20e	25.8e	0.11	4.0
Bowdle	48	−25	13.0	0.10	1.0
Brookings	55	−24	17.2	0.50	5.0
Canton	52	−24	21.0	0.24	6.0
Centerville				0.76	8.5
Chamberlain	60	−19	23.2	0.24	2.5
Clark	51	−26d	19.4	0.43	4.3
Desmet	52	−22	17.8	0.80	8.0
Doland	56	−24	17.4	0.23	2.8
Elkpoint	54	−32	22.2	0.62	11.0
Farmingdale				0.13	1.8
Faulkton	51	−21	17.8	0.22	2.2
Flandreau	56	−24	17.3	0.44	4.5
Forestburg	57	−23	18.8	0.45	4.5
Fort Meade	65	−20	25.9	1.53	15.3
Fort Randall	59e	−26e	22.0e	0.10	1.0
Gannvalley	52	−20	21.1	0.40	4.0
Gary	48	−22	19.1	0.30	2.5
Grand River School	51	−28	18.3	0.09	3.0
Greenwood	61	−22	26.2	0.55	5.5
Hartman	52	−24	19.0	0.25	2.8
Hotch City	61	−23	23.1	0.13	3.0
Howard	60	−25	20.2	0.30	3.0
Howell	51	−22	18.6	0.15	1.5
Interior	60	−33	29.1	0.45	4.1
Ipswich	49	−25	16.2	0.01	0.5
Kimball	52	−20	21.2	0.41	4.1
Leola	50	−26	14.7	0.02	1.5
Leslie	62	−24	21.9	T.	T.
Marion	50	−20	20.2	0.45	7.0
Mellette	55	−26	18.8	0.10	1.0
Menno	55	−20	21.6	0.48	5.1
Millbank	57	−25	19.4	0.30	3.0
Mitchell	55	−19	21.4	0.05	0.5
Mound City	45	−27	14.0	T.	T.
Oelrichs	59	−16	21.6	0.60	6.0
Pine Ridge	60	−31	22.8	0.03	0.3
Plankinton	53	−20	18.2	0.40	4.5
Redfield	55	−27	17.1	0.11	1.0
Rosebud	60	−25	25.0	0.20	3.0
St. Lawrence	56	−22	20.8	0.05	0.5
Silver City				0.28	2.8
Sioux Falls	53	−21	20.2	0.48	4.8
Sisseton Agency	51	−24	18.2	0.12	1.2
Spearfish	62	−21	26.8	1.31	11.5

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
South Dakota—Cont'd.	°	°	°	Ins.	Ins.
Vermilion	52	−16	23.0	0.77	13.0
Watertown [d]	43	−26	14.8	......	
Waubay	43	−29	14.8	0.25	2.5
Wentworth	55	−24	18.2	0.29	2.9
Wolsey	......	......	......	0.45	4.5
Tennessee.					
Andersonville	60	10	37.1	4.63	......
Ashwood	73	14	38.9	5.49	......
Benton	65	11	38.4	4.01	
Bluff City	......	......	......	3.04	1.0
Bolivar	65[b]	16[c]	36.4[c]	6.10	4.0
Bristol	57	9	33.0	2.77	1.0
Byrdstown	62	13	36.2	5.36	2.3
Carthage	67	13	37.2	5.09	0.5
Charleston	......	......	......	3.71	
Clarksville	66	14	36.4	7.30	1.2
Clinton	......	......	......	4.80	1.0
Decatur	64	11	37.0	3.78	T.
Dickson	64	14	36.8	4.18	2.0
Elizabethton	58	8	34.8	2.85	1.0
Erasmus	65	8	35.0	6.15	0.8
Florence	64	15	37.3	4.71	1.0
Franklin	64	16	38.2	4.90	......
Grace *[1]	60	10	38.7	6.70	
Greeneville	59	10	35.2	3.19	3.6
Harriman	62	12	35.6	5.91	T.
Hohenwald	73	11	36.1	6.62	2.0
Iron City	66	11	37.9	5.94	2.0
Isabella	......	......	......	3.21	1.5
Johnsonville	68	8	35.8	5.61	......
Jonesboro	......	......	......	3.22	......
Kingston	......	......	......	5.29	T.
Lafayette *[a]	61	13	33.4	7.30	T.
Lewisburg	68	15	38.4	5.70	T.
Liberty	69	11	37.8	5.11	......
Lynnville	62	15	37.0	5.15	T.
McKenzie	61	11	37.6	5.05	......
Maryville	65	14	37.6	3.77	T.
Newport	63	14	36.6	3.70	1.0
Nunnelly	68	12	36.9	4.50	......
Oakhill	64	10	37.1	4.40	1.0
Palmetto	65	15	38.8	5.58	T.
Peryear *[b]	60	10	35.9	7.45	1.0
Pope	67	8	36.7	5.77	1.0
Rogersville	58	12	34.8	4.04	0.8
Rugby	70	7	34.9	4.68	2.5
Savannah	65	18	39.2	6.64	3.0
Sewanee	65	10	36.2	4.47	T.
Silverlake	52	2	31.6	3.12	3.2
Springdale	63[b]	8	33.9[d]	4.49	3.0
Tazewell	......	......	......	4.03	5.5
Tellico Plains	68	14	39.0	3.59	0.5
Tracy City	64	11	35.5	4.22	0.2
Trenton	68	7	37.3	6.92	1.0
Tullahoma	65	12	36.8	5.90	1.0
Union City	......	......	......	4.00	2.0
Waynesboro	62[d]	9	35.8	6.95	3.0
Wildersville [c]	66	8	36.4	5.21	T.
Yukon	66	14	39.9	5.00	......
Texas.					
Albany	66	10	42.4	T.	T.
Alvin	......	......	......	1.05	
Anna	74	12	41.7	0.87	
Anson	......	......	......	T.	T.
Arthur	......	......	......	1.63	1.6
Austin *b* *[b]	69	18	45.0	......	......
Ballinger	70	15	42.0	0.27	T.
Bastrop	77	11	50.3	0.45	
Beaumont	71	30	49.8	1.16	
Beeville	80	24	51.4	1.27	
Big Spring	......	......	......	0.62	
Blanco	70	18	46.1	0.71	
Boerne *[1]	70	22	45.9	0.97	
Booth	......	......	......	2.06	
Bowie	73	7	42.0	T.	T.
Brazoria	77	29	52.2	2.18	
Brenham	76	22	49.8	1.30	
Brighton	80	30	55.8	2.10	
Burnet	80	17	48.6	0.27	
Camp Eagle Pass	78	28	51.1	0.24	
Coleman	76	15	45.2	0.35	
College Station	......	19	......	0.90	
Columbia	76	27	51.2	1.48	
Comanche	71	12	44.5	0.54	1.0
Corsicana	79	14	49.2	0.86	
Cotulla	77	30	52.4	0.28	
Cuero	78	25	52.6	1.51	
Dallas	72	15	43.1	1.18	T.
Danevang	77	24	51.0	2.55	
Dublin	69	11	41.6	0.55	1.0
Duval	76	21	49.5	0.19	T.
Estelle	73	14	43.3	0.62	6.8
Fort Brown	84	......	......	0.50	
Fort Davis	71	13	44.2	0.16	
Fort McIntosh	80	31	59.0	1.40	
Fort Ringgold	86	34	61.4	0.02	
Fredericksburg	70	20	46.2	0.84	
Gainesville	73[c]	12[c]	40.3[c]	0.35	T.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Texas—Cont'd.	°	°	°	Ins.	Ins.
Georgetown *[1]	71	18	46.4	0.27	
Grapevine	74	9	43.8	0.51	1.1
Hale Center	77	8	43.2	0.10	1.0
Hallettsville	77	25	50.8	0.87	
Haskell	75	8	42.4	0.07	
Henrietta	78	7	41.2	0.02	0.2
Hewitt	......	......	......	0.20	T.
Hondo	......	......	......	0.65	
Houston	74	27	49.6	1.16	T.
Huntsville	73	22	47.8	1.68	
Ira	71	11	43.0	0.51	
Jacksonville	73[c]	19[c]	45.2[c]	2.91	2.0
Jasper	83	19[f]	48.0[c]	1.50	
Kaufman	72	13	43.0	1.61	0.4
Kent	......	......	......	T.	
Kopperl	......	......	......	0.00	
Kerrville	76	15	45.8	0.76	
Lampasas	74	18	44.5	0.84	
Lapara	......	......	......	2.50	
Laureles Ranch	......	......	......	1.54	
Llano *[b]	70	20	48.0	0.65	
Longview	72	21	44.0	2.52	
Luling	76	20	49.2	1.34	
Menardville	74	15	43.2	1.60	
Mount Blanco	72	6	39.4	T.	T.
Nacogdoches	71	22	44.8	2.51	T.
New Braunfels	74	23	49.6	1.08	
Panter	......	......	......	0.22	0.5
Port Lavaca	77	26	52.9	1.80	
Rhineland	72	7	42.0	T.	T.
Rockisland	79	23	50.8	1.27	T.
Rockport	75	30	57.0	1.34	
Runge	79	22	52.8	1.12	
Sanderson	70	22	46.8	T.	
San Marcos	76	23	50.0	0.89	
San Saba	74	17	45.3	0.99	
Santa Gertrudes Ranch	......	......	......	1.75	1.5
Sherman	71	12	41.8	0.92	0.3
Sugarland	78	25	51.3	0.76	
Sulphur Springs	71	12	42.4	1.44	0.8
Temple *a*	71	17	44.9	0.30	
Temple *b*	70	17	43.6	0.36	
Tulia	72	−2	37.9	0.20	2.0
Tyler	69	21	45.2	1.10	......
Victoria	......	......	......	1.55	
Waco	76	18	46.3	0.76	
Waxahachie	73	14	44.2	1.20	T.
Weatherford	70	11	43.0	0.19	1.9
Wichita Falls	......	......	......	0.10	
Utah.					
Alpine	......	......	......	1.20	12.0
Aneth	63	4	34.0	0.06	0.6
Blackrock	52	−25	24.4	0.26	6.5
Bluecreek *	55	−5	27.4	0.40	4.0
Castledale	57	−18	22.9	0.20	......
Cisco	50	−12	28.5	1.35	7.0
Corinne	52	−10	27.3	0.98	6.0
Coyoto	61	−27	26.7	0.45	4.5
Deseret	56	−17	25.0	0.48	3.8
Emery	53	−8	28.3	0.10	1.0
Escalante	52	−10	27.6	1.90	19.0
Farmington	41	−7[f]	26.2[f]	1.65	12.5
Fillmore	74	−15	30.8	1.03	......
Fort Duchesne	39	−22	13.2	0.17	1.7
Frisco	57	−6	31.2	0.95	9.5
Giles	56	−5	28.9	T.	T.
Government Creek	54	−14	26.0	0.58	5.8
Green River	55	−9	26.5	0.28	2.8
Grover	56	−5	29.7	0.80	8.0
Heber	54	−20	25.5	0.50	6.0
Henefer	57	−27	25.2	1.39	12.2
Huntsville	......	......	......	1.16	12.5
Kelton *[1]	50	−10	23.0	0.20	2.0
Lasal	55	−8	28.8	1.52	15.2
Levan	49	−11	25.5	0.53	6.2
Loa	55	−30	20.3	0.80	8.0
Logan	43	−12	24.9	0.28	......
Lund	58	−24	25.8	0.24	4.0
Manti	60	−22	27.1	0.52	7.5
Marysvale	60	−21	27.8	0.50	5.0
Meadowville	48	−20	22.0	0.40	3.0
Millville	......	......	......	0.39	......
Minersville	56	−14	28.2	0.91	9.0
Moab	54	4	31.8	0.40	3.5
Mount Nebo	48	−10	27.0	0.45	4.0
Mount Pleasant	54	−11	29.2	1.30	13.0
Ogden	49	−10	26.1	0.90	......
Park City	48	−14	24.3	1.90	19.0
Parowan	57	−14	28.2	1.18	13.3
Pinto	57	−23	27.0	0.61	11.8
Promontory	......	......	......	0.25	2.5
Provo	53	−7	28.0	0.35	5.6
Ranch	61	−15	28.3	2.41	23.2
Richfield	59	−16	27.9	0.35	3.5
St. George	67	2	34.4	0.73	11.0
Scipio	62	−28	26.1	0.80	9.0
Snowville	53	−21	23.8	0.60	6.0
Soldier Summit	49	−15	20.9	0.55	5.5

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Utah—Cont'd.	°	°	°	Ins.	Ins.
Terrace	......	......	......	T.	T.
Thistle	60	−25	29.0	1.90	19.0
Tooele	42	−6	26.4	0.67	......
Tropic	58	−14	28.2	0.30	3.0
Vernal	46	−11	23.4	0.21	2.3
Wellington	......	......	......	0.24	2.4
Woodruff	55	−38	17.2	......	......
Vermont.					
Bennington	51	−9	21.4	2.70	14.0
Burlington	40	−1	19.3	0.66	5.5
Chelsea	41	−11	14.2	2.20	11.0
Cornwall	40	−7	17.8	1.22	11.0
Enosburg Falls	46	−13	16.6	2.97	26.0
Hartland	43	−16	15.4	1.90	16.0
Jacksonville	42	−15	15.0	2.70	24.0
Manchester	46	−12	18.4	1.37	13.6
Norwich	43	−15	15.4	1.74	12.0
St. Johnsbury	45	−16	14.2	0.89	5.5
Vernon *[6]	46	−16	19.5	1.64	5.0
Wells	48	−14	17.2	1.39	16.5
Woodstock	42	−20	14.1	2.23	18.0
Virginia.					
Alexandria	49	14	31.6	3.28	5.1
Ashland	54	12	33.4	2.93	4.0
Barboursville	65	12	35.8	3.30	5.0
Bedford	55	13	34.6	......	......
Bigstone Gap	56	13	33.4	4.87	5.3
Birdsnest [2]	......	......	30.6	2.10	2.0
Blacksburg	56	7	30.5	3.35	5.5
Bonair	58	13	34.4	3.55	4.0
Buckingham	61	......	......	3.90	......
Burkes Garden	50	5	29.0	3.95	6.0
Callaville	64	10	35.8	2.51	5.0
Charlottesville	58	15	33.8	3.24	3.5
Cliftonforge	48	8	28.0	2.60	5.0
Columbia	55	10	33.6	2.90	3.0
Dale Enterprise	64	8	30.8	2.27	10.0
Farmville	58	11	33.6	2.30	1.0
Fredericksburg	50	12	32.3	3.30	3.0
Grahams Forge [a]	56	6	31.5	1.29	4.1
Hampton	62	19	37.2	2.27	0.7
Hot Springs	56	7	29.5	3.65	5.5
Lexington	58	9	33.2	4.22	8.0
Lincoln	56	9	30.4	2.42	6.0
Newport News	61	21	40.2	2.23	0.5
Petersburg	69	14	36.8	2.95	1.0
Quantico	52	14	33.0	......	......
Radford	......	......	......	1.16	5.0
Riverton	......	......	......	2.40	7.0
Roanoke	57	10	36.0	2.63	......
Salem	......	......	......	2.89	4.2
Speers Ferry	......	......	......	4.00	4.0
Spottsville	65	12	36.2	3.08	0.5
Stanardsville	57	3	29.4	2.57	4.0
Staunton	56	12	33.8	2.21	7.0
Stephens City [g]	60	8	31.2	2.69	11.0
Westpoint	53	11	32.8	2.65	4.0
Williamsburg	63	12	35.2	2.79	3.0
Woodstock	62	10	31.8	2.35	9.5
Wytheville	59	9	32.0	1.90	5.0
Washington.					
Aberdeen	51	12	37.1	6.76	2.1
Anacortes	......	......	......	3.60	15.0
Bremerton	56	14	39.3	5.82	5.0
Brinnon	55	18	38.2	8.56	3.0
Buchanan's Farm	......	......	......	1.31	7.9
Cedonia	52	−12	23.8	1.07	7.3
Centralia [a]	56	5	36.4	2.10	3.5
Cheney	......	......	......	1.99	14.0
Clearwater	53	17	39.0	9.95	2.8
Cle Elum	47	−11	27.1	2.73	12.5
Colville	49	−20	25.0	1.05	3.8
Conconully	47	−13	22.0	0.86	3.5
Connell	......	......	......	1.00	8.0
Coupeville	52	13	38.9	2.66	16.0
Dayton	65	−6	31.6	1.41	10.8
East Sound	55	2	37.2	2.95	10.0
Ellensburg	51	−10	27.4	1.26	6.2
Ellensburg (near)	46	−6	26.2	0.63	5.5
Grandmound	54	7	37.6	5.26	3.9
Granite Falls	......	......	......	5.00	13.8
Ilwaco	65	17	42.0	7.10	3.0
Lacenter	57	8	36.4	6.15	15.0
Lakeside	52	3	28.2	1.01	2.0
Lind	56	−9	26.4	1.68	14.0
Mayfield	55	10	35.9	6.89	17.0
Mottinger Ranch	68	0	32.3	1.15	8.2
Mount Pleasant	60	9	35.6	5.06	4.7
Moxee Valley	59	−5	29.4	0.42	2.6
Northport	46	−22	21.3	0.45	0.6
Olga	54	14	37.6	2.40	7.5
Olympia	58	12	39.0	7.15	8.5
Pasco	62	−2	31.1	1.31	11.0
Pinehill	57	−8	31.3	2.68	14.7
Pomeroy	64	−10	30.4	2.07	17.0
Port Townsend	55	13	39.4	1.91	8.5
Pullman [d]	55	−12	26.2	1.55	10.0
Renton	......	......	......	4.61	10.0

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
Washington—Cont'd.					
Ritzville	......	......	......	1.27	10.5
Rosalia	54	−14	26.8	1.14	5.3
Silvana	57	2	36.8	4.11	18.0
Snohomish	55	2	36.4	5.79	13.5
Snoqualmie	......	8	......	7.11	9.0
Southbend	59	17	40.4	7.80	2.0
Sprague	......	......	......	2.10	10.0
Stampede	......	......	......	4.80	14.0
Sunnyside	63	−11	29.2	0.73	3.5
Twin	56	14	38.3	7.51	9.4
Union	53	14	38.8	9.33	5.6
Usk	50	−18	24.2	0.42	2.9
Vancouver	58	1	36.9	3.86	8.5
Vashon	55	14	38.4	6.56	13.4
Waterville	47	−13	21.4	1.57	6.2
Wenatchee (near)	49	− 4	25.6	1.45	9.0
Whatcom	59	10	38.9	2.77	8.5
Wilbur	52	−19	22.8	1.56	11.2
West Virginia.					
Beckley	55	6	29.9	......	......
Beverly	53	2	27.6	3.05	19.0
Bluefield	56	8	31.9	3.37	10.0
Buckhannon *a*	51	2	29.9	4.63	9.0
Burlington	54	4	28.6	2.50	10.0
Central	54	5	29.1	3.45	11.5
Charleston	......	......	......	4.29	......
Creston	......	......	......	1.72	......
Cuba	54	8	31.2	2.11	7.1
Dayton	55	4	29.9	3.15	10.8
Elkhorn	58	9	33.7	4.39	7.6
Fairmont	......	......	......	3.20	10.5
Foster	66	11	31.8	1.12	1.2
Glenville	56	6	29.2	4.26	13.0
Grafton	54	3	29.2	3.82	14.2
Green Sulphur	58	0	29.7	4.28	12.0
Harpers Ferry	......	......	......	3.20	9.5
Hinton *a*	......	......	......	4.14	8.0
Hinton *b*	57	9	31.0	......	......
Huntington	60	12	30.4	4.10	5.5
Josiah	53	4	29.3	3.00	10.0
Leonard	57	7	28.4	5.79	10.4
Lewisburg	55	5	28.8	8.52	8.2
Logan	59	9	34.3	5.70	2.0
Magnolia	54	0	27.9	3.29	10.5
Mannington	58	2	30.7	2.71	11.0
Martinsburg	54	7	29.0	3.25	10.0
Morgantown	51	7	29.4	3.63	12.0
Moscow	48	5	27.8	1.45	6.5
Moundsville	50	8	30.8	1.76	4.8
New Martinsville	54	9	31.2	2.65	5.6
Nuttallburg	60	9	30.2	4.00	10.0
Oceana	57	2	31.8	5.51	......
Oldfields	65	7	32.4	1.64	8.0
Parsons	50	− 1	27.6	4.55	8.0
Philippi *a*	53	0	25.6	1.95	19.5
Point Pleasant	60	13	33.2	4.21	4.0
Powellton	60	9	32.8	5.18	7.0
Princeton	55	3	31.2	5.45	12.0
Romney	54	5	29.8	2.65	8.0
Rowlesburg	......	......	......	4.97	18.6
Terra Alta	46	− 1	24.6	4.60	29.0
Uppertract	57	10	31.0	2.28	11.0
Wellsburg	47	5	27.2	2.68	7.5
Weston *a*	......	......	......	4.17	10.2
Weston *b*	57	5	31.6	......	......
Wheeling *a*	......	......	......	1.56	7.7
Wheeling *b*	53	12	32.4	1.84	6.0
Williamson	64	9	33.4	5.84	3.0
Wisconsin.					
Amherst	36	−25	15.4	0.55	5.5
Antigo	38	−28	16.0	0.60	6.0
Appleton	41	−18	18.8	0.55	8.8
Ashland	......	......	......	0.81	8.0
Barron	42	−38	13.6	1.50	......
Beloit	50	−13	22.8	0.65	6.0
Brodhead	51	−23	21.8	0.60	6.0
Butternut	41	−34	12.8	0.91	9.5
Chilton	44	−18	17.4	0.37	4.4
Citypoint	......	......	......	0.65	6.0
Darlington	......	......	......	0.30	3.0
Delavan	47	−16	21.8	......	......
Dodgeville	48	−24	19.2	0.70	6.0
Easton	46	−30	18.3	0.68	8.0
Eau Claire	42	−33	16.6	0.77	8.0
Florence	36	−26[c]	15.0	0.75	7.5
Fond du Lac	44	−16	21.8	0.17	2.0
Grand River Locks	......	......	......	0.20	3.5
Grantsburg	42	−35	13.8	0.85	8.5
Harvey	48	−16	21.4	0.14	2.0
Hayward	45	−39	15.1	1.01	10.1
Hillsboro	49	−31	18.1	0.70	7.0
Knapp	40	......	......	0.60	6.0
Koepenick	45	−35	15.0	1.00	10.0
Ladysmith	39	−35	14.9	1.95	19.5
Lancaster	48	−21	20.2	0.92	9.5
Madison	45	−15	21.0	0.17	1.7
Manitowoc	43	−15	21.8	0.26	3.0
Meadow Valley	50	−29	17.2	0.34	6.2

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
Wisconsin—Cont'd.					
Medford	48	−30	16.6	1.00	10.0
Menasha	......	......	......	0.69	6.8
Neillsville	42	−38	13.8	1.25	8.0
New Holstein	49	−17	19.6	0.40	4.0
New London	41	−23	17.8	0.42	5.5
North Crandon	44[e]	−32[e]	12.6[e]	1.05	10.5
Oconto	41	−24	19.9	1.45	14.5
Osceola	42	−37	13.2	0.76	8.5
Oshkosh	43	−19	20.7	0.90	9.0
Pepin	46	−32	19.9	0.87	10.0
Pine River	42	−25	18.2	0.50	5.5
Portage	47	−21	21.6	0.25	5.0
Port Washington	50	−19	21.1	0.07	0.8
Prairie du Chien *a*	50	−26	22.3	0.58	7.5
Prairie du Chien *b*	......	......	......	0.53	9.5
Prentice	42[h]	−11[h]	17.3[h]	1.50	15.0
Racine	51	−14	24.6	0.37	......
Sheboygan	43	−13	23.6	0.45	4.5
Stevens Point	41	−34	17.4	0.60	6.5
Valley Junction	56	−22	21.8	0.45	4.5
Viroqua	45	−23	18.8	0.87	9.2
Watertown	45	−20	20.8	0.34	3.5
Waukesha	43	−14	20.8	0.29	3.6
Waupaca	38	−30	17.0	0.40	6.8
Wausau	39	−31	16.8	1.37	......
Wausaukee	40	−28	18.2	0.70	7.0
Westfield	45	−24	19.8	0.55	5.5
Whitehall	42	−35	17.1	1.24	13.5
Wyoming.					
Alcova	56	−21	26.4	0.41	4.0
Basin	42	−39	12.4	0.16	1.6
Bedford	49	−26	16.0	0.40	4.0
Border	39	−29	13.9	0.09	1.0
Buffalo	57	−24	23.2	T.	T.
Burlington	52	−22	20.8	T.	T.
Centennial	48	−20[e]	19.8[e]	T.	T.
Chugwater	62	−34	26.0	0.35	3.0
Daniel	45	−34	9.3	0.20	2.0
Diamondville	47	−22	18.6	0.04	1.4
Embar	56	−25	24.5	0.30	3.0
Evanston	48	−21	20.1	0.57	4.6
Fort Laramie	65	−30	24.4	0.19	5.0
Fort Washakie	54	−33	20.6	0.26	2.5
Fort Yellowstone	44	−30	17.4	0.96	9.6
Fourbear	62	−32	21.0	0.08	1.5
Griggs	64	−41	23.3	0.25	2.6
Hyattville	52	−32	21.8	0.40	4.0
Iron Mountain	53	−22	25.4	0.12	1.2
Kimball Ranch [c]	60	−30	22.2	0.30	3.0
Laramie	52	−18	22.2	T.	T.
Leo	46	−36	19.0	0.48	12.2
Lovell [1]	50	−34	15.4	T.	T.
Lusk	55	−30	22.0	0.22	2.2
Moore	58	−22	26.4	0.22	4.0
Parkman	63	−31	26.6	0.09	3.5
Pinebluff	60	−25	24.8	0.10	1.0
Rawlins	47	−20	21.2	0.67	6.7
Red Bank	52	−33	22.6	0.50	5.0
Rocksprings	59	−13	24.0	0.07	0.7
Saratoga	54	−15	23.4	0.70	7.0
Sheridan	55	−30	21.7	0.15	1.5
South Pass City	35	−25	10.6	T.	T.
Thayne	42	−26	15.1	0.34	3.7
Thermopolis	58	−38	17.7	0.40	4.0
Cuba.					
Aguacate	93	......	......	0.81	
Australia	86	43	66.1	0.87	
Banaguises	87	46	67.2	0.90	
Batabano	78	46	64.8	1.32	
Calimete	87	47	68.7	0.94	
Camajuani	75	39	57.6	0.90	
Ciego de Avila	......	......	......	1.49	
Cruces	......	......	......	0.50	
Gibara	89	55	71.0	6.71	
Guabairo	......	......	......	0.37	
Guanajay	82	49	65.4	1.24	
Guantanamo	89	56	72.9	1.19	
Guines	......	......	......	1.06	
Holguin	85	52	70.6	3.48	
Magdalena	85[f]	44[f]	66.6[h]	0.20	
Manzanillo	87	60	74.6	0.40	
Moron Trocha	86	51	67.2	1.67	
Pinar del Rio	83	46	66.2	0.19	
Romelie Guantanamo	......	......	......	0.06	
San Ceyetano	90	40	65.8	1.15	
Sancti Spiritus	81	53	66.4	0.72	
Santa Clara	86	46	66.1	1.09	
San Vincente	......	......	......	0.46	
Soledad	87	47	66.4	0.42	
Soledad, Guantanamo	91	53	72.9	0.41	
Union de Reyes	84	53	69.6	0.29	
Yaguajay	86	52	67.7	2.59	
Yateras	......	......	......	1.04	
Porto Rico.					
Adjuntas	85	52	68.7	6.69	
Aguadilla	85	60	74.6	9.76	
Aguirre	90	65	77.4	2.09	
Arecibo	92	61	74.7	10.47	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
Porto Rico—Cont'd.					
Barros	89	53	70.4	12.80	
Bayamon	91	61	76.0	8.64	
Caguas	85	59	72.2	14.10	
Canovanas	85	66	75.6	8.04	
Cayey	90	54	71.7	6.01	
Corozal	88	56	72.6	12.56	
Fajardo	89	65	77.0	5.56	
Guayama	......	......	......	2.35	
Hacienda Coloso	92	59	73.5	7.18	
Hacienda Perla	86	67	74.6	12.56	
Humacao	85	58	71.8	10.10	
Isabela	87	65	73.8	11.65	
Juana Diaz	89	64	76.9	0.94	
La Isolina	84	60	71.2	12.92	
Las Marias	92	63	75.1	3.76	
Manati	92	60	75.1	6.73	
Maunabo	85	68	76.4	7.06	
Mayaguez	85	62	73.4	4.67	
Ponce	86	59	75.0	1.31	
Rio Piedras	......	......	......	7.84	
San Lorenzo	90	58	74.7	3.59	
San Salvador	84	59	70.9	6.49	
Santa Isabel [d]	87	62	76.2	2.66	
Utuado	86	58	72.8	5.16	
Yauco	89	60	74.0	3.14	
Mexico.					
Ciudad P. Diaz	77	30	53.7	0.24	
Coatzacoalcos	85	50	67.6	1.85	
Leon de Aldamas	76	31	55.8	0.00	
Vera Cruz	83	57	69.8	0.65	
New Brunswick.					
St. John	48	2	21.2	3.52	9.0
Isthmus of Panama.					
Alhajuela	87	66	75.9	......	
La Boca	89	73	79.9	5.20	

Late reports for December, 1901.

Stations.	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Alaska.					
Coal Harbor	50	8	32.1	8.87	4.0
Eagle	30	−52	−7.0	0.19	4.2
Fort Liscum	39	−13	21.2	7.53	50.1
Kenai	45	−17	18.4	0.19	T.
Killisnoo	41	21	33.6	5.30	12.0
Orca	47	9	31.5	9.75	22.0
Wood Island	47	2	33.8	11.10	9.0
California.					
Kernville	......	......	......	0.00	
Needles	75	31	56.2	0.00	
Ogilby *[1]	82	30	57.4	0.00	
Snedden	......	......	......	0.00	
Yuba City *[b]	68	29	49.4	1.36	
Colorado.					
Clearview	54	−19	26.3	0.68	11.0
Telluride	51	−12	23.6	2.28	37.2
Connecticut.					
Winsted	58	− 4	27.4	......	......
Florida.					
Rockwell	88	21	55.6	0.65	
Georgia.					
Columbus	68	13	42.8	5.50	
Iowa.					
Tipton	48	−15	23.2	......	......
Kentucky.					
Fords Ferry	69	−22	30.1	5.19	4.0
Louisiana.					
Jeanerette	80	16	51.4	3.75	2.0
New Iberia	76[a]	......	......	6.20	T.
Maine.					
Bemis [e]	28	0	12.4	......	......
Maryland.					
Hancock	68	− 2	31.0	5.69	2.2
Massachusetts.					
Taunton	64	− 9	30.3	9.76	......
Mississippi.					
Leakesville	78	......	......	9.93	
Nebraska.					
Tablerock	......	......	......	0.40	4.0
Nevada.					
Sodaville	78	7	39.0	0.10	1.0
New Hampshire.					
Berlin Mills	57	−28	20.9	5.01	29.0
Hanover	62	−18	23.2	3.44	12.0
New York.					
Saratoga Springs	52	−11	23.2	3.10	15.5
North Carolina.					
Biltmore	58	9	34.0	8.38	5.9
Selma	75	11	41.8	4.49	T.
North Dakota.					
Mayville	40	−31	11.2	0.60	6.0
South Carolina.					
Due West	67	14	42.6	6.94	2.3
Winnsboro	72	13	41.0	3.85	
South Dakota.					
Aberdeen	40	−28	10.8	0.20	2.0

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Texas.	°	°	°	*Ins.*	*Ins.*
Blanco	70	10	40.5	0.02	
Kerrville	85	8	42.6	0.40	
Llano *[5]	80	16	49.0	0.60	
Vermont.					
Newport	61	−20	23.6	2.61	16.0
Virginia.					
Columbia	68	3	36.0	4.50	0.5
Newport News	......	14	......	4.59	T.
Washington.					
Ellensburg (near)	48	7	29.7	1.30	1.5
West Virginia.					
Burlington	70	0	29.5	5.80	2.0
Wisconsin.					
Valley Junction	41	−25	16.7	......	......
Wausaukee	40	−23	18.4	......	......
Wyoming.					
Centennial	44	−26	18.4	0.64	13.0
Fort Laramie	75	−41	26.8	1.12	9.0
Leo	40	−26	20.2	0.82	18.5
Moore	52	−26	26.5	1.10	22.4
Porto Rico.					
Cidra	85	70	77.8	5.60	
San Lorenzo	89	59	74.6	5.29	
Vieques	89	68	79.1	4.55	

EXPLANATION OF SIGNS.

*Extremes of temperature from observed readings of dry thermometer.

A numeral following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:

[1] Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. ÷ 4.
[2] Mean of 8 a. m. + 8 p. m. ÷ 2.
[3] Mean of 7 a. m. + 7 p. m. ÷ 2.
[4] Mean of 6 a. m. + 6 p. m. ÷ 2.
[5] Mean of 7 a. m. + 2 p. m. ÷ 2.
[6] Mean of readings at various hours reduced to true daily mean by special tables.

The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.

An italic letter following the name of a station, as "Livingston *a*," "Livingston *b*," indicates that two or more observers, as the case may be, are reporting from the same station. A small roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance "n" denotes 14 days missing.

CORRECTIONS.

December, 1901, T. S. Ranch, Colo., make total precipitation read 0.66 instead of 0.55. Dover, N. J., make total precipitation 7.32 instead of 7.42.

NOTE.—The following changes have been made in the names of stations: Myers, Fla., changed to Fort Myers. Martinsdale, Mont., changed to Twodot.

TABLE III.—*Resultant winds from observations at 8 a. m. and 8 p. m., daily, during the month of January, 1902.*

Stations.	Component direction from— N.	S.	E.	W.	Resultant. Direction from—	Duration.
	Hours.	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
New England.						
Eastport, Me	21	7	8	33	n. 61 w.	29
Portland, Me	26	9	5	37	n. 62 w.	36
Northfield, Vt	21	33	5	14	s. 37 w.	15
Boston, Mass	17	12	7	39	n. 81 w.	32
Nantucket, Mass	23	12	12	28	n. 56 w.	19
Block Island, R. I	22	11	14	32	n. 59 w.	21
New Haven, Conn	29	11	5	28	n. 52 w.	29
Middle Atlantic States.						
Albany, N. Y	28	15	13	22	n. 35 w.	16
Binghamton, N. Y.†	9	4	13	12	n. 11 e.	5
New York, N. Y	26	11	10	30	n. 53 w.	25
Harrisburg, Pa.†	12	2	11	13	n. 45 w.	3
Philadelphia, Pa	28	14	11	24	n. 43 w.	19
Scranton, Pa	22	18	17	21	n. 45 w.	6
Atlantic City, N. J	33	9	9	27	n. 37 w.	30
Cape May, N. J	28	9	10	27	n. 42 w.	26
Baltimore, Md	22	13	13	28	n. 59 w.	18
Washington, D. C	27	13	16	18	n. 8 w.	14
Lynchburg, Va	23	13	13	32	n. 62 w.	22
Norfolk, Va	25	20	17	13	n. 39 e.	6
Richmond, Va	26	15	11	22	n. 45 w.	16
South Atlantic States.						
Charlotte, N. C	20	19	16	21	n. 79 w.	5
Hatteras, N. C	35	7	11	20	n. 18 w.	29
Raleigh, N. C	25	13	11	25	n. 49 w.	18
Wilmington, N. C	24	17	12	24	n. 60 w.	14
Charleston, S. C	21	16	9	29	n. 76 w.	21
Columbia, S. C	21	18	17	25	n. 69 w.	8
Augusta, Ga	24	8	11	32	n. 53 w.	26
Savannah, Ga	21	11	13	31	n. 61 w.	21
Jacksonville, Fla	27	13	19	23	n. 16 w.	15
Florida Peninsula.						
Jupiter, Fla	28	17	12	21	n. 39 w.	14
Key West, Fla	34	5	31	7	n. 40 e.	38
Tampa, Fla	28	10	15	22	n. 21 w.	19
Eastern Gulf States.						
Atlanta, Ga*	24	12	13	28	n. 51 w.	19
Macon, Ga.†	10	10	7	12	w.	5
Pensacola, Fla.†	16	4	11	5	n. 27 e.	13
Mobile, Ala	31	20	11	12	n. 5 w.	11
Montgomery, Ala	24	15	19	19	n.	9
Meridian, Miss	14	7	7	11	n. 30 w.	8
Vicksburg, Miss	25	18	20	15	n. 36 e.	9
New Orleans, La	31	12	22	13	n. 25 e.	21
Western Gulf States.						
Shreveport, La	21	23	19	17	s. 45 e.	3
Fort Smith, Ark	18	10	26	20	n. 37 e.	10
Little Rock, Ark	24	16	13	24	n. 54 w.	14
Corpus Christi, Tex	33	13	20	7	n. 31 e.	23
Fort Worth, Tex	21	24	16	17	s. 18 w.	3
Galveston, Tex	26	14	25	10	n. 51 e.	19
Palestine, Tex	27	17	21	10	n. 48 e.	15
San Antonio, Tex	29	15	27	6	n. 56 e.	25
Taylor, Tex.†	13	9	5	8	n. 37 w.	5
Ohio Valley and Tennessee.						
Chattanooga, Tenn	17	17	13	27	w.	14
Knoxville, Tenn	23	18	12	25	n. 69 w.	14
Memphis, Tenn	24	23	13	18	n. 79 w.	5
Nashville, Tenn	24	17	14	23	n. 35 w.	16
Lexington, Ky.†	10	12	5	10	s. 68 w.	5
Louisville, Ky	20	21	12	21	s. 84 w.	9
Evansville, Ind.†	11	11	6	10	w.	4
Indianapolis, Ind	24	17	9	25	n. 51 w.	21
Cincinnati, Ohio	21	19	17	23	n. 72 w.	6
Columbus, Ohio	17	18	13	23	s. 84 w.	10
Pittsburg, Pa	24	21	9	25	n. 79 w.	16
Parkersburg, W. Va	20	19	12	21	n. 84 w.	10
Elkins, W. Va	18	15	5	32	n. 84 w.	27
Lower Lake Region.						
Buffalo, N. Y	11	18	10	32	s. 72 w.	23
Oswego, N. Y	14	32	15	18	s. 9 w.	18
Rochester, N. Y	8	27	9	33	s. 51 w.	31
Erie, Pa	17	21	8	28	s. 79 w.	20
Cleveland, Ohio	16	21	15	26	s. 66 w.	12
Sandusky, Ohio	7	9	5	18	s. 81 w.	13
Toledo, Ohio	16	19	11	33	s. 82 w.	22
Detroit, Mich	18	16	10	32	n. 85 w.	22
Upper Lake Region.						
Alpena, Mich	19	18	2	35	n. 88 w.	33
Escanaba, Mich	13	23	4	38	s. 74 w.	35
Grand Haven, Mich	18	16	17	25	n. 76 w.	8
Houghton, Mich.†	11	5	9	9	n.	6
Marquette, Mich	14	17	6	39	s. 85 w.	33
Port Huron, Mich	21	20	6	32	n. 88 w.	26
Sault Ste. Marie, Mich	13	22	24	20	s. 24 e.	10
Chicago, Ill	19	16	10	33	n. 83 w.	23
Milwaukee, Wis	16	16	3	38	w.	35
Green Bay, Wis	15	26	3	30	s. 68 w.	29
Duluth, Minn	20	17	4	41	n. 80 w.	38
North Dakota.						
Moorhead, Minn	20	20	11	26	w.	15
Bismarck, N. Dak	30	10	12	28	n. 39 w.	26
Williston, N. Dak	24	15	5	31	n. 71 w.	28
Upper Mississippi Valley.						
St. Paul, Minn	24	22	8	25	n. 83 w.	17
La Crosse, Wis.†	9	14	3	10	s. 54 w.	9
Davenport, Iowa	13	17	7	36	s. 82 w.	29
Des Moines, Iowa	26	14	15	24	n. 37 w.	15
Dubuque, Iowa	15	22	11	27	s. 66 w.	18
Keokuk, Iowa	20	17	11	30	n. 81 w.	19
Cairo, Ill	26	19	14	21	n. 45 w.	10
Springfield, Ill	27	13	11	30	n. 54 w.	24
Hannibal, Mo.†	10	8	5	14	n. 77 w.	9
St. Louis, Mo	23	20	8	22	n. 78 w.	14
Missouri Valley.						
Columbia, Mo.*	11	10	8	11	n. 72 w.	3
Kansas City, Mo	23	19	12	22	n. 68 w.	11
Springfield, Mo	19	22	16	19	s. 45 w.	4
Lincoln, Nebr	22	24	12	16	s. 63 w.	4
Omaha, Nebr	22	23	12	18	s. 80 w.	6
Valentine, Nebr	21	10	6	35	n. 69 w.	31
Sioux City, Iowa †	11	11	6	10	w.	4
Pierre, S. Dak	29	15	14	15	n. 4 w.	14
Huron, S. Dak	24	19	12	23	n. 66 w.	12
Yankton, S. Dak. †	....	....	....	....	....	....
Northern Slope.						
Havre, Mont	16	17	9	39	s. 88 w.	30
Miles City, Mont	15	30	5	21	s. 47 w.	22
Helena, Mont	13	23	8	36	s. 70 w.	30
Kalispell, Mont	11	16	6	38	s. 81 w.	32
Rapid City, S. Dak	18	8	9	25	n. 58 w.	19
Cheyenne, Wyo	27	17	3	25	n. 66 w.	24
Lander, Wyo	12	25	22	16	s. 25 e.	14
North Platte, Nebr	17	11	9	37	n. 78 w.	29
Middle Slope.						
Denver, Colo	21	19	21	18	n. 56 e.	4
Pueblo, Colo	24	15	18	21	n. 18 w.	10
Concordia, Kans	18	26	12	17	s. 32 w.	9
Dodge, Kans	23	13	15	26	n. 48 w.	15
Wichita, Kans	25	25	16	10	e.	6
Oklahoma, Okla	22	24	14	14	s.	2
Southern Slope.						
Abilene, Texas	22	26	14	16	s. 27 w.	4
Amarillo, Tex	21	24	15	23	s. 69 w.	8
Southern Plateau.						
El Paso, Texas	22	6	28	21	n. 24 e.	18
Santa Fe, N. Mex	20	23	24	9	s. 79 e.	15
Flagstaff, Ariz	14	14	22	20	e.	2
Phoenix, Ariz	8	10	29	24	s. 68 e.	5
Yuma, Ariz	36	5	17	15	n. 4 e.	31
Independence, Cal	22	14	12	29	n. 65 w.	19
Middle Plateau.						
Carson City, Nev	20	16	16	21	n. 51 w.	6
Winnemucca, Nev	26	11	19	12	n. 25 e.	17
Modena, Utah	10	12	21	30	s. 77 w.	9
Salt Lake City, Utah	18	21	21	16	s. 59 e.	6
Grand Junction, Colo	17	14	25	19	n. 63 e.	7
Northern Plateau.						
Baker City, Oreg	12	32	26	16	s. 27 e.	22
Boise, Idaho	14	16	21	24	s. 56 w.	4
Lewiston, Idaho †	3	8	18	7	s. 66 e.	11
Pocatello, Idaho	12	23	18	29	s. 45 w.	16
Spokane, Wash	17	22	23	13	s. 63 e.	11
Walla Walla, Wash	7	40	3	17	s. 23 w.	36
North Pacific Coast Region.						
Neah Bay, Wash	1	16	44	9	s. 67 e.	38
Port Crescent, Wash.*	1	6	18	8	s. 63 e.	11
Seattle, Wash	20	28	21	6	s. 62 e.	17
Tacoma, Wash	14	34	15	14	s. 3 e.	20
Astoria, Oreg	29	12	30	12	n. 47 e.	25
Portland, Oreg	20	16	25	14	n. 70 e.	12
Roseburg, Oreg	19	16	17	22	n. 59 w.	6
Middle Pacific Coast Region.						
Eureka, Cal	18	21	23	14	s. 72 e.	10
Mount Tamalpais, Cal	34	11	10	21	n. 40 w.	17
Red Bluff, Cal	30	15	18	10	n. 28 e.	17
Sacramento, Cal	24	17	26	14	n. 60 e.	14
San Francisco, Cal	34	9	10	22	n. 26 w.	28
South Pacific Coast Region.						
Fresno, Cal	27	12	13	28	n. 45 w.	21
Los Angeles, Cal	24	8	21	27	n. 21 w.	17
San Diego, Cal	30	7	18	23	n. 12 w.	24
San Luis Obispo, Cal	33	5	7	20	n. 25 w.	31
West Indies.						
Basseterre, St. Kitts Island	18	3	49	1	n. 73 e.	50
Bridgetown, Barbados	10	2	57	0	n. 83 e.	57
Cienfuegos, Cuba	42	4	31	3	n. 36 e.	47
Grand Turk †	9	6	22	1	n. 82 e.	21
Havana, Cuba	23	3	36	6	n. 56 e.	36
Kingston, Jamaica	....	....	....	....	....	....
Port of Spain, Trinidad	15	11	34	2	n. 83 e.	32
Puerto Principe, Cuba	41	1	34	3	n. 38 e.	51
Roseau, Dominica, W. I	21	4	47	2	n. 69 e.	48
San Juan, Porto Rico	9	25	39	5	s. 65 e.	38
Santiago de Cuba, Cuba	47	6	11	10	n. 1 e.	39
Santo Domingo, W. I	53	2	8	2	n. 8 e.	51
Willemstad, Curaçao	4	3	60	0	e.	60

* From observations at 8 p. m. only.

† From observations at 8 a. m. only.

TABLE IV.—*Thunderstorms and auroras, January, 1902.*

States.	No. of stations.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total. No.	Total. Days.	
Alabama	52	T.																		3	1	1	2											2	9	5	T.
		A.																																	0	0	A.
Arizona	56	T.											4																					4	1	T.
		A.																																	0	0	A.
Arkansas	57	T.																		3								1	5	1	1		1		12	6	T.
		A.																																	0	0	A.
California	167	T.																		1												3			4	2	T.
		A.																																	0	0	A.
Colorado	81	T.																			1														1	1	T.
		A.																							1		1								2	2	A.
Connecticut	21	T.																																	0	0	T.
		A.																																	0	0	A.
Delaware	5	T.																																	0	0	T.
		A.																																	0	0	A.
Dist. of Columbia	4	T.																																	0	0	T.
		A.																																	0	0	A.
Florida	47	T.																																	0	0	T.
		A.																																	0	0	A.
Georgia	55	T.																1			1	2	2											1	7	5	T.
		A.																																	0	0	A.
Idaho	34	T.																																	0	0	T.
		A.																									1	1							2	2	A.
Illinois	92	T.																																	0	0	T.
		A.																																	0	0	A.
Indiana	58	T.																										2							2	1	T.
		A.																																	0	0	A.
Indian Territory	11	T.																		1		1			1							1			4	4	T.
		A.																																	0	0	A.
Iowa	149	T.																																	0	0	T.
		A.														1	1																		2	2	A.
Kansas	77	T.																																	0	0	T.
		A.																																	0	0	A.
Kentucky	41	T.																				1	1					6							8	3	T.
		A.																																	0	0	A.
Louisiana	46	T.																				1												3	4	2	T.
		A.																																	0	0	A.
Maine	19	T.																																	0	0	T.
		A.																																	0	0	A.
Maryland	48	T.																		1															1	1	T.
		A.							1																										1	1	A.
Massachusetts	48	T.																																	0	0	T.
		A.																																	0	0	A.
Michigan	106	T.																																	0	0	T.
		A.																							1										1	1	A.
Minnesota	67	T.																																	0	0	T.
		A.													1	5	1																		7	3	A.
Mississippi	44	T.													1							2												5	8	3	T.
		A.																																	0	0	A.
Missouri	95	T.																																	0	0	T.
		A.																																	0	0	A.
Montana	40	T.																																	0	0	T.
		A.					1								1		1				1														4	4	A.
Nebraska	142	T.																																	0	0	T.
		A.																																	0	0	A.
Nevada	40	T.																																	0	0	T.
		A.																																	0	0	A.
New Hampshire	19	T.																										1							1	1	T.
		A.		1						1				1																					3	3	A.
New Jersey	51	T.																																	0	0	T.
		A.																																	0	0	A.
New Mexico	31	T.											1																					1	1	T.
		A.																																	0	0	A.
New York	99	T.																																	0	0	T.
		A.																																	0	0	A.
North Carolina	56	T.											1											5											6	2	T.
		A.																																	0	0	A.
North Dakota	48	T.																																	0	0	T.
		A.														4	1																		5	2	A.
Ohio	128	T.																											4						4	1	T.
		A.																																	0	0	A.
Oklahoma	23	T.																																	0	0	T.
		A.																		1															1	1	A.
Oregon	74	T.					1				1																								2	2	T.
		A.																																	0	0	A.
Pennsylvania	91	T.																																	0	0	T.
		A.																									1								1	1	A.
Rhode Island	7	T.																																	0	0	T.
		A.																																	0	0	A.
South Carolina	46	T.														1		1				1	1											2	6	5	T.
		A.																											1						1	1	A.
South Dakota	56	T.																																	0	0	T.
		A.															5	1																	6	2	A.
Tennessee	56	T.																				1	1												2	2	T.
		A.																																	0	0	A.
Texas	95	T.												1		2			1									1		1		1		7	6	T.
		A.																																	0	0	A.
Utah	47	T.																1																	1	1	T.
		A.							1																						1				2	2	A.
Vermont	16	T.																																	0	0	T.
		A.																																	0	0	A.
Virginia	50	T.																					2						1						3	2	T.
		A.																																	0	0	A.
Washington	64	T.			1				1	3																									5	3	T.
		A.																																	0	0	A.
West Virginia	43	T.																											2						2	1	T.
		A.			1																														1	1	A.
Wisconsin	60	T.																																	0	0	T.
		A.																																	0	0	A.
Wyoming	31	T.																																	0	0	T.
		A.																				1	1			1	1		1	1			6	6	A.
Sums	2,893	T.	0	0	1	0	1	0	1	4	0	0	6	1	0	4	0	3	1	9	3	10	14	0	1	0	1	15	8	2	4	2	13	104	....	T.
		A.	0	1	1	0	1	0	2	1	0	0	0	1	1	1	16	4	0	1	1	0	1	1	2	0	4	2	1	1	2	0	0	45	....	A.

TABLE V.—*Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded 0.25 in any 5 minutes, or 0.75 in 1 hour during January, 1902, at all stations furnished with self-registering gages.*

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Albany, N. Y	27			0.30														*			
Alpena, Mich	10-11			0.24														*			
Atlanta, Ga	31			0.73														0.26			
Atlantic City, N. J	21-22			0.92														*			
Baltimore, Md	21-22			1.60														*			
Binghamton, N. Y	21-22			0.33														*			
Bismarck, N. Dak	25			0.04														*			
Boise, Idaho	24-25			0.25														*			
Boston, Mass	22			0.59														0.20			
Buffalo, N. Y	21-22			2.25														*			
Cairo, Ill	28-29			1.81														*			
Charleston, S. C	21			0.31														0.21			
Charlotte, N. C	30-31			0.62														0.28			
Chattanooga, Tenn	27			0.79														0.31			
Chicago, Ill	20-21			0.30														*			
Cincinnati, Ohio	25-26			0.87														0.23			
Cleveland, Ohio	21-22			0.27														*			
Columbia, Mo	25			0.55														*			
Columbia, S. C	21			1.18														0.39			
Columbus, Ohio	26-27			0.78														*			
Corpus Christi, Tex	13-14			1.89														0.22			
Davenport, Iowa	20-21			0.41														*			
Denver, Colo	22-23			0.08														*			
Des Moines, Iowa	25-26			0.54														*			
Detroit, Mich	26			0.21														*			
Dodge, Kans	28			0.16														*			
Duluth, Minn	25-26			0.23														*			
Eastport, Me	26			1.04														0.26			
Elkins, W. Va	29-30			1.51														0.16			
Erie, Pa	21-22			1.21														*			
Escanaba, Mich	25-26			0.17														*			
Evansville, Ind	28-29			0.89														*			
Fort Smith, Ark	18			0.78														0.17			
Fort Worth, Tex	28-29			0.21														*			
Fresno, Cal	23-24			0.29														*			
Galveston, Tex	28-29			0.32														0.17			
Grand Junction, Colo	17			0.17														0.06			
Harrisburg, Pa	21-22			1.82														0.25			
Hatteras, N. C	21			0.80														0.57			
Huron, S. Dak	25-26			0.28														*			
Indianapolis, Ind	20-21			0.34														*			
Jacksonville, Fla	16			0.04																	
Jupiter, Fla	4-5			0.73														0.17			
Kalispell, Mont	19			0.18														*			
Kansas City, Mo	20-21			0.41														*			
Key West, Fla	16			0.12					0.12												
Knoxville, Tenn	27			0.94														0.26			
Lexington, Ky	26-27			1.11														0.53			
Lincoln, Nebr	20			0.47														*			
Little Rock, Ark	25-26			2.46														0.46			
Los Angeles, Cal	24			1.32														0.51			
Louisville, Ky	26-27			1.50														0.50			
Macon, Ga	21			0.64														0.39			
Memphis, Tenn	26			2.01														0.47			
Meridian, Miss	20			0.79														0.63			
Milwaukee, Wis	29			0.18														*			
Montgomery, Ala	31			0.70														0.70			
Nantucket, Mass	27			0.51														0.19			
Nashville, Tenn	20-21			0.68														0.46			
New Haven, Conn	26-27			0.82														0.21			
New Orleans, La	29			0.39														0.34			
New York, N. Y	21-22			0.82														0.14			
Norfolk, Va	21			1.01														0.54			
Northfield, Vt	21-22			1.43														*			
Oklahoma, Okla	25			0.18														0.17			
Omaha, Nebr	20			0.31														*			
Parkersburg, W. Va	26-27			0.70														0.27			
Philadelphia, Pa	21-22			1.05														0.18			
Pittsburg, Pa	26-27			0.37														*			
Pocatello, Idaho	31			0.62														*			
Portland, Me	21-22			1.00														0.15			
Portland, Oreg	6-7			0.92														0.28			
Pueblo, Colo	23			0.11														*			
Raleigh, N. C	21			1.39														0.38			
Richmond, Va	21			1.68														0.43			
Rochester, N. Y	11-12			0.84														*			
St. Louis, Mo	25			0.27														0.10			
St. Paul, Minn	25-26			0.32														0.15			
Salt Lake City, Utah	2			0.30														*			
San Diego, Cal	24			0.49														0.25			
Sandusky, Ohio	21			0.24														*			
San Francisco, Cal	21			0.38														0.17			
Savannah, Ga	21			0.16														0.10			
Scranton, Pa	21-22			1.07														*			
Seattle, Wash	6-7			1.41														0.30			
Spokane, Wash	29-30			0.37														*			
Springfield, Ill	20-21			0.56														*			
Tampa, Fla	16			0.24														0.13			
Toledo, Ohio	20-21			0.30														*			
Topeka, Kans	20-21			0.75														*			
Valentine, Nebr	25			0.32														*			
Vicksburg, Miss	20			0.44														0.44			
Washington, D. C	21			1.36														0.56			
Wilmington, N. C	21			0.95														0.47			
Basseterre, St. Kitts	28			0.21									0.21								
Bridgetown, Barbados	24			0.07				0.07													
Cienfuegos, Cuba	16			0.12																	
Havana, Cuba	4-5	6:15 p. m.	11:35 a. m.	6.41	11:00 p. m.	11:55 p. m. 0.49	0.13	0.17	0.20	0.25	0.35	0.43	0.51	0.67	0.12 0.74	0.82	0.93				
					3:40 a. m.	4:15 a. m. 2.53	0.07	0.15	0.21	0.31	0.41	0.48	0.58	0.55	0.58						
					5:50 a. m.	6:35 a. m. 3.40	0.07	0.12	0.18	0.23	0.32	0.43	0.55	0.71	0.88	0.92	0.99	1.22			
					8:05 a. m.	8:45 a. m. 4.96	0.08	0.12	0.18	0.29	0.42	0.45	0.62	0.72	0.74	0.77	0.81				

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TABLE V.—*Accumulated amounts of precipitation for each 5 minutes, etc.*—Continued.

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Port of Spain, Trinidad	6	11:35 a. m.	12:07 p. m.	0.74	11:35 a. m.	11:50 a. m.	0.00	0.18	0.57	0.71	0.73	...	...	...	...	...	...	...	...	...	...
Puerto Principe, Cuba	3-4	...	...	1.00	...	...	...	...	...	...	...	...	...	...	...	...	...	0.37	...	...	...
Roseau, Dominica	26-27	...	...	0.44	...	...	...	...	...	...	...	...	...	...	...	...	...	0.10	...	...	...
San Juan, Porto Rico	13	4:15 p. m.	7:45 p. m.	2.69	5:15 p. m.	6:15 p. m.	0.41	0.21	0.44	0.68	0.93	1.09	1.29	1.41	1.44	1.46	1.51	1.85	...	...	...
San Juan, Porto Rico	15	9:45 a. m.	7:40 p. m.	2.88	10:00 a. m.	11:35 a. m.	0.04	0.10	0.14	0.25	0.38	0.62	0.90	1.15	1.34	1.44	1.50	1.60	1.88	2.07	...
San Juan, Porto Rico	19-20	6:35 p. m.	9:45 a. m.	2.31	9:03 p. m.	9:48 p. m.	0.03	0.10	0.26	0.36	0.43	0.47	0.61	0.66	0.75	0.83	...	...	...	...	...
Santiago de Cuba	8	...	...	0.76	...	...	...	...	...	...	...	...	...	...	...	...	...	0.71	...	...	...
Santo Domingo, W. I.	1	...	...	0.21	...	...	...	...	...	...	...	...	...	...	...	...	...	0.21	...	...	...
Willemstad, Curaçao	7	...	...	0.14	...	...	...	...	...	0.10	...	...	...	...	...	...	...	...	...	...	...

TABLE VI.—*Data furnished by the Canadian Meteorological Service, January, 1902.*

Stations.	Pressure, in inches. Actual, reduced to mean of 24 hours.	Pressure. Sea level, reduced to mean of 24 hours.	Pressure. Departure from normal.	Temperature. Mean.	Temperature. Departure from normal.	Temperature. Mean maximum.	Temperature. Mean minimum.	Precipitation. Total.	Precipitation. Departure from normal.	Precipitation. Depth of snow.
	Ins.	*Ins.*	*Ins.*	°	°	°	°	*Ins.*	*Ins.*	*Ins.*
St. Johns, N. F.	29.72	29.86	.00	27.1	+ 3.3	33.5	20.8	4.98	−0.96	3.0
Sydney, C. B. I	29.80	29.93	.00	26.5	+ 6.0	32.5	20.4	3.34	−1.47	8.0
Halifax, N. S	29.86	29.97	.00	27.1	+ 5.3	34.5	19.7	3.29	−2.40	12.3
Grand Manan, N. B.	29.91	29.96	−.03	25.3	+ 1.9	32.7	17.9	3.78	−1.59	6.3
Yarmouth, N. S.	29.92	30.00	+.01	27.8	+ 1.5	34.4	21.1	3.25	−1.97	13.7
Charlottetown, P. E. I.	29.80	29.93	−.03	21.9	+ 4.9	28.8	15.1	2.07	−1.34	12.1
Chatham, N. B	29.92	29.95	−.02	13.2	+ 3.4	24.2	2.2	3.28	0.00	15.0
Father Point, Que	29.95	29.98	.00	12.2	+ 4.2	20.5	3.9	2.45	−0.25	19.3
Quebec, Que	29.68	30.02	.00	11.8	+ 2.7	18.9	4.7	2.85	−0.82	22.6
Montreal, Que	29.84	30.06	+.02	13.2	+ 1.5	20.2	6.2	3.02	−0.26	26.6
Bissett, Ont	29.45	30.09	+.07	7.1	+ 0.7	19.5	− 5.4	0.96	−1.05	9.6
Ottawa, Ont	29.80	30.14	+.11	11.8	+ 2.2	20.3	3.3	3.90	+0.90	30.9
Kingston, Ont	29.74	30.08	+.03	18.1	+ 1.0	26.6	9.6	1.60	−1.66	11.6
Toronto, Ont	29.68	30.09	+.04	23.3	+ 1.9	30.5	16.1	2.59	+0.08	25.3
White River, Ont	28.65	30.04	+.03	3.9	+ 4.3	18.9	−11.2	2.42	+1.09	24.2
Port Stanley, Ont	29.43	30.11	+.04	22.2	0.0	29.6	14.7	3.15	+0.47	30.4
Saugeen, Ont	29.32	30.07	+.04	23.0	+ 2.6	30.0	16.0	1.69	−1.77	16.4
Parry Sound, Ont	29.33	30.08	+.07	15.4	+ 1.6	26.9	4.0	2.09	−1.06	20.5
Port Arthur, Ont	29.35	30.10	+.06	10.9	+ 7.8	20.9	0.9	0.50	−0.31	5.0
Winnipeg, Man	29.25	30.14	+.03	7.5	+14.3	19.3	− 4.4	0.12	−0.54	1.1
Minnedosa, Man	28.22	30.14	+.04	9.0	+16.2	20.6	− 2.6	0.06	−0.57	0.6
Qu'Appelle, Assin	27.73	30.08	.00	11.7	+15.5	20.2	3.2	0.26	−0.12	2.6
Medicine Hat, Assin.	27.77	30.15	+.08	20.4	+14.9	31.7	9.2	0.98	+0.65	9.8
Swift Current, Assin.	27.46	30.16	+.07	16.9	+13.8	25.3	8.6	0.17	−0.44	1.7
Calgary, Alberta	26.40	30.08	+.05	20.3	+11.9	31.2	9.3	0.40	−0.17	1.0
Banff, Alberta	25.38	30.22	......	13.7	+ 1.6	23.0	4.5	1.75	+0.45	17.5
Edmonton, Alberta	27.68	30.07	+.04	17.4	+15.6	26.2	8.6	0.42	−0.31	4.2
Prince Albert, Sask	28.42	30.06	−.03	6.2	+14.6	17.4	− 5.0	0.26	−0.70	2.6
Battleford, Sask	28.29	30.12	+.04	9.5	+15.4	19.6	− 0.6	0.10	−0.28	1.0
Kamloops, B. C	28.91	30.17	+.21	26.8	+ 3.8	32.7	21.0	0.86	0.00	7.2
Victoria, B. C.	30.05	30.15	+.18	39.6	+ 1.1	43.9	35.2	3.13	−2.54	9.0
Barkerville, B. C	25.63	30.11	+.22	17.3	− 0.5	25.8	8.8	1.80	−0.91	18.0
Hamilton, Bermuda	29.93	30.09	−.04	61.1	− 0.9	66.2	56.0	3.18	−1.67	0.0

TABLE VII.—*Heights of rivers referred to zeros of gages, January, 1902.*

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Mississippi River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
St. Paul, Minn.[1]	1,954	14	.....	.....	.....	.....	.....	.....
Reeds Landing, Minn.[1]	1,884	12	.....	.....	.....	.....	.....	.....
La Crosse, Wis.	1,819	12	2.6	1, 8, 9, 14, 17, 19-24	1.7	29	2.4	0.9
Prairie du Chien, Wis.[1]	1,759	18	.....	.....	.....	.....	.....	.....
Dubuque, Iowa[1]	1,699	15	.....	.....	.....	.....	.....	.....
Leclaire, Iowa[1]	1,609	10	.....	.....	.....	.....	.....	.....
Davenport, Iowa[1]	1,593	15	.....	.....	.....	.....	.....	.....
Muscatine, Iowa	1,562	16	3.3	1-3	2.7	13-16, 23-28	.....	0.6
Galland, Iowa[1]	1,472	8	.....	.....	.....	.....	.....	.....
Keokuk, Iowa[1]	1,463	15	.....	.....	.....	.....	.....	.....
Hannibal, Mo.[2]	1,402	13	.....	.....	.....	.....	.....	.....
Grafton, Ill	1,306	23	3.6	6	0.8	29	2.4	2.8
St. Louis, Mo.	1,264	30	9.5	7	-1.2	30	3.0	10.7
Chester, Ill	1,189	30	1.1	11, 12	-1.4	30, 31	0.2	2.5
New Madrid, Mo.	1,003	34	24.9	9	8.5	23	11.8	16.4
Memphis, Tenn.	843	33	21.0	10, 11	4.0	25	17.6	17.0
Helena, Ark.	767	42	27.9	12	7.9	26	15.9	20.0
Arkansas City, Ark.	635	42	27.5	14	9.0	28	18.7	18.5
Greenville, Miss.	595	42	23.3	14	6.6	28	15.4	16.7
Vicksburg, Miss	474	45	25.3	15	6.6	29	17.6	18.7
New Orleans, La.	108	16	7.3	17	3.8	31	5.8	3.5
Missouri River.								
Bismarck, N. Dak	1,309	14	3.9	16-18	1.2	2	3.2	2.7
Pierre, S. Dak.[1]	1,114	14	.....	.....	.....	.....	.....	.....
Sioux City, Iowa[1]	784	19	.....	.....	.....	.....	.....	.....
Omaha, Nebr.[1]	669	18	.....	.....	.....	.....	.....	.....
St. Joseph, Mo	481	10	2.1	28	-0.8	2-4	0.4	2.9
Kansas City, Mo.[3]	388	21	7.1	28	4.0	3, 4	5.6	3.1
Boonville, Mo.	199	20	6.8	29	5.3	3	6.2	1.5
Hermann, Mo.[4]	103	24	5.8	5	1.7	29	3.2	4.1
Illinois River.								
Peoria, Ill	135	14	7.5	1, 2	6.8	23-27	7.1	0.7
Youghiogheny River.								
Confluence, Pa.	59	10	4.8	28	1.4	14, 15, 20	2.3	3.4
West Newton, Pa.[3]	15	23	10.5	30	1.0	8, 9, 14, 15	2.8	9.5
Allegheny River.								
Warren, Pa.	177	14	2.6	1	1.1	29-31	1.4	1.5
Oil City, Pa	123	13	3.5	30, 31	1.9	21	2.3	1.6
Parker, Pa.	73	20	3.6	1	1.7	21-24	2.4	1.9
Monongahela River.								
Weston, W. Va	161	18	11.2	27	-0.1	15, 16	0.8	11.3
Fairmont, W. Va	119	25	20.0	27	1.5	15-24	3.7	18.5
Greensboro, Pa.[3]	81	18	22.1	27	7.0	16-22	8.8	15.1
Lock No. 4, Pa.	40	28	25.9	28	6.2	18-22	9.2	19.7
Conemaugh River.								
Johnstown, Pa.	64	7	3.5	28	2.0	19-21, 26	2.6	1.5
Red Bank Creek.								
Brookville, Pa	35	8	1.2	1-7	1.0	8-31	1.0	0.2
Beaver River.								
Elwood Junction, Pa.[5]	10	14	.....	.....	.....	.....	.....	.....
Great Kanawha, River.								
Charleston, W. Va.	58	30	21.8	31	3.9	16	7.9	17.9
Little Kanawha River.								
Glenville, W. Va	103	20	13.7	27	-1.7	20	1.6	15.4
New River.								
Hinton, W. Va	95	14	8.5	31	2.6	15	3.9	5.9
Cheat River.								
Rowlesburg, W. Va.[6]	36	14	6.6	27	2.4	4	.....	4.2
Ohio River.								
Pittsburg, Pa	966	22	15.5	28	1.2	15	4.4	14.3
Davis Island Dam, Pa	960	25	14.3	28	3.3	15	6.0	11.0
Wheeling, W. Va	875	36	21.6	1	4.0	17	7.7	17.6
Parkersburg, W. Va	785	36	23.8	1	5.2	20, 21	9.3	18.6
Point Pleasant, W. Va.	703	39	38.3	1	4.6	20	12.4	33.7
Huntington, W. Va.	660	50	42.7	1	7.5	20	16.8	35.2
Catlettsburg, Ky	651	50	43.7	1	6.0	20	16.7	37.7
Portsmouth, Ohio	612	50	43.5	1	7.4	21	17.8	36.1
Cincinnati, Ohio.	499	50	44.0	3	8.8	23	19.9	35.2
Madison, Ind	413	46	35.7	3	8.5	23	17.8	27.2
Louisville, Ky	367	28	16.5	3	4.9	23, 24	8.5	11.6
Evansville, Ind.	184	35	31.3	5, 6	6.5	25, 26	15.6	24.8
Paducah, Ky.[3]	47	40	30.2	7	8.0	21	17.5	22.2
Cairo, Ill	1,073	45	31.0	8	9.5	22	19.3	21.5
Muskingum River.								
Zanesville, Ohio	70	20	14.8	1	6.9	25, 26	8.7	7.9
Scioto River.								
Columbus, Ohio[1]	110	17	.....	.....	.....	.....	.....	.....
Miami River.								
Dayton, Ohio	77	18	1.1	2-5	0.7	25	0.9	0.4
Wabash River.								
Mount Carmel, Ill.[4]	50	15	4.0	2, 4	1.9	26, 27	2.7	2.1
Licking River.								
Falmouth, Ky.[7]	30	25	17.4	28	1.0	21	5.7	16.4
Kentucky River.								
Frankfort, Ky	65	31	28.8	31	6.0	7-14	9.7	22.8
Clinch River.								
Speers Ferry, Va.	156	20	10.2	28	0.2	20, 21, 24	2.1	10.0
Clinton, Tenn	52	25	24.8	1	5.1	17-19	9.2	19.7
Tennessee River.								
Knoxville, Tenn.	635	29	19.0	1	2.8	20	5.5	16.2
Kingston, Tenn.	556	25	27.3	1	3.3	18-20	6.7	24.0
Chattanooga, Tenn.	452	33	40.8	2	5.1	18, 19	11.7	35.7
Bridgeport, Ala.	402	24	27.7	3	3.5	18	9.3	24.2
Florence, Ala.	255	16	21.0	6	4.0	19	10.3	17.0
Riverton, Ala.	225	25	32.7	7	4.8	18	15.3	27.9
Johnsonville, Tenn.	95	24	28.5	9, 10	6.1	18	16.5	22.4
Cumberland River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Burnside, Ky	516	50	41.3	31	2.8	17-19	10.4	38.5
Carthage, Tenn.	305	40	38.2	31	3.2	18	11.7	35.0
Nashville, Tenn	189	40	37.8	31	5.2	18	14.9	32.6
Clarksville, Tenn	126	42	43.4	31	7.1	19	18.5	36.3
Arkansas River.								
Wichita, Kans	832	10	1.1	2	0.8	22, 23	0.9	0.3
Webbers Falls, Ind. T.[9]	465	23	.....	.....	.....	.....	.....	.....
Fort Smith, Ark.[8]	403	22	1.3	1	-0.2	30	0.8	1.5
Dardanelle, Ark	256	21	1.0	1, 2	0.3	30	0.5	0.7
Little Rock, Ark.	176	23	4.2	30, 31	1.5	17-19	2.1	2.7
White River.								
Newport, Ark	150	26	1.0	1	0.2	20-25	0.5	0.8
Yazoo River.								
Yazoo City, Miss	80	25	11.5	2	3.0	23	7.6	8.5
Red River.								
Arthur City, Tex	638	27	3.5	1	2.6	26, 27	2.9	0.9
Fulton, Ark	515	28	10.5	30, 31	2.9	24, 25	4.1	7.6
Shreveport, La.	327	29	1.3	3, 31	-1.0	25, 26	-0.2	2.3
Alexandria, La	118	33	2.0	1	-2.1	21-28	-1.0	4.1
Ouachita River.								
Camden, Ark	304	39	26.0	31	4.9	20-22	7.6	21.1
Monroe, La.	122	40	12.5	1	2.8	24-27	4.9	9.7
Atchafalaya River.								
Melville, La.	100	31	21.8	19	11.0	31	18.7	10.8
Susquehanna River.								
Wilkesbarre, Pa	183	14	14.4	23	2.2	17-21	5.1	12.2
Harrisburg, Pa	69	17	10.0	23	2.0	18, 19	3.8	8.0
West Branch Susquehanna.								
Williamsport, Pa	39	20	6.9	23	1.6	20	3.0	5.3
Juniata River.								
Huntingdon, Pa	90	24	6.3	22	4.0	1-21	4.3	2.3
Potomac River.								
Cumberland, Md.	290	8	5.1	28, 30, 31	2.5	20, 21	3.5	2.6
Harpers Ferry, W. Va	172	16	11.0	1	1.2	15-21	3.9	9.8
James River.								
Lynchburg, Va	260	18	6.7	29	1.2	18-20	2.8	5.5
Richmond, Va.	111	12	20.5	1	0.4	15, 16, 19	2.3	20.1
Roanoke River.								
Weldon, N. C.	129	30	44.5	2	9.3	16	15.2	35.2
Cape Fear River.								
Fayetteville, N. C	112	38	35.5	1	5.2	21	10.8	30.3
Edisto River.								
Edisto, S. C	75	6	3.7	7, 8	2.6	1	3.3	1.1
Pedee River.								
Cheraw, S. C	149	27	35.6	1	3.7	17, 18	9.2	31.9
Black River.								
Kingstree, S. C	52	12	8.1	11, 12	4.4	29-31	5.6	3.7
Lynch Creek.								
Effingham, S. C	35	12	13.5	5	5.0	24	7.6	8.5
Santee River.								
St. Stephens, S. C.	97	12	15.2	7	7.1	23, 24	9.2	8.1
Congaree River.								
Columbia, S. C.	37	15	19.0	1	1.5	19, 28	3.3	17.5
Wateree River.								
Camden, S. C.	45	24	30.5	1	10.4	28	14.5	20.1
Waccamaw River.								
Conway, S. C	40	7	5.3	12, 13	3.2	31	4.0	2.1
Savannah River.								
Calhoun Falls, S. C	347	15	7.0	1	3.0	26, 27	3.6	4.0
Augusta, Ga	268	32	25.9	1	9.2	17, 18, 20, 28, 29	11.0	16.7
Broad River.								
Carlton, Ga.	30	11	4.7	1	2.8	17, 18, 24, 26, 27	3.2	1.9
Flint River.								
Albany, Ga	80	20	13.8	15	3.2	31	7.5	10.6
Chattahoochee River.								
Westpoint, Ga	239	20	19.0	1	3.2	18	5.2	15.8
Ocmulgee River.								
Macon, Ga.	125	18	15.7	1	3.1	15, 16, 18, 19	4.5	12.6
Oconee River.								
Dublin, Ga	79	30	15.3	5	2.4	17-20	5.5	12.9
Coosa River.								
Rome, Ga.	271	30	28.0	1	2.7	17, 18	6.5	25.3
Gadsden, Ga.	144	18	23.3	4	2.8	18	9.2	20.5
Alabama River.								
Montgomery, Ala.	265	35	46.8	1	4.6	18, 19	15.7	42.2
Selma, Ala.	212	35	46.6	3	6.5	18-20	18.9	40.1
Tombigbee River.								
Columbus, Miss.	303	33	12.4	31	-1.0	16-18	3.4	13.4
Demopolis, Ala	155	35	39.0	3, 4	5.5	19	20.6	33.5
Black Warrior River.								
Tuscaloosa, Ala.	129	43	44.0	1	5.0	18	17.4	39.0
Brazos River.								
Kopperl, Tex	369	21	-1.6	1-31	-1.6	1-31	-1.6	0.0
Waco, Tex.	301	22	0.9	1-5	0.6	21-31	0.7	0.3
Booth, Tex	76	39	-0.3	31	-0.7	19-24	-0.6	0.4
Red River of the North.								
Moorhead, Minn.[1]	418	26	.....	.....	.....	.....	.....	.....
Columbia River.								
Umatilla, Oreg.[8]	270	25	2.8	13	1.1	28	2.0	1.7
The Dalles, Oreg.	166	40	4.5	11, 12	1.0	31	3.0	3.5
Willamette River.								
Albany, Oreg	118	20	10.2	9	2.8	30, 31	4.9	7.4
Portland, Oreg.	12	15	9.9	9	2.3	31	4.7	7.6
Sacramento River.								
Red Bluff, Cal.	265	23	6.7	3	0.6	31	1.9	6.1
Sacramento, Cal	64	29	12.0	4, 5	9.8	31	10.8	2.2

[1] Frozen. [2] Frozen for 29 days. [3] Frozen for 1 day. [4] Frozen for 4 days. [5] Frozen for 24 days. [6] Frozen for 22 days. [7] Frozen for 8 days. [8] Frozen for 3 days. [9] Data incomplete.

Chart I. Tracks of Centers of High Areas. January, 1902.

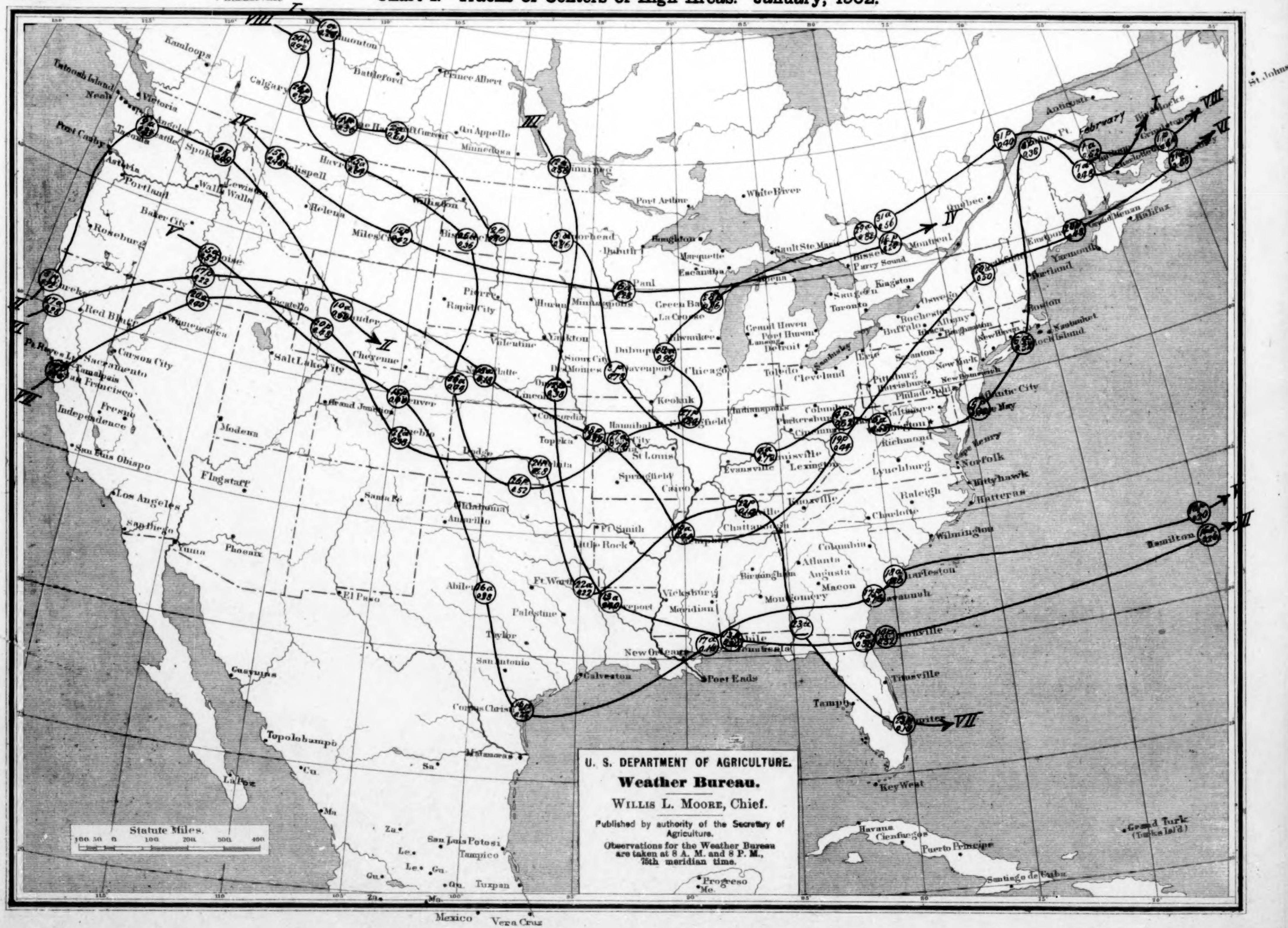

Chart II. Tracks of Centers of Low Areas. January, 1902.

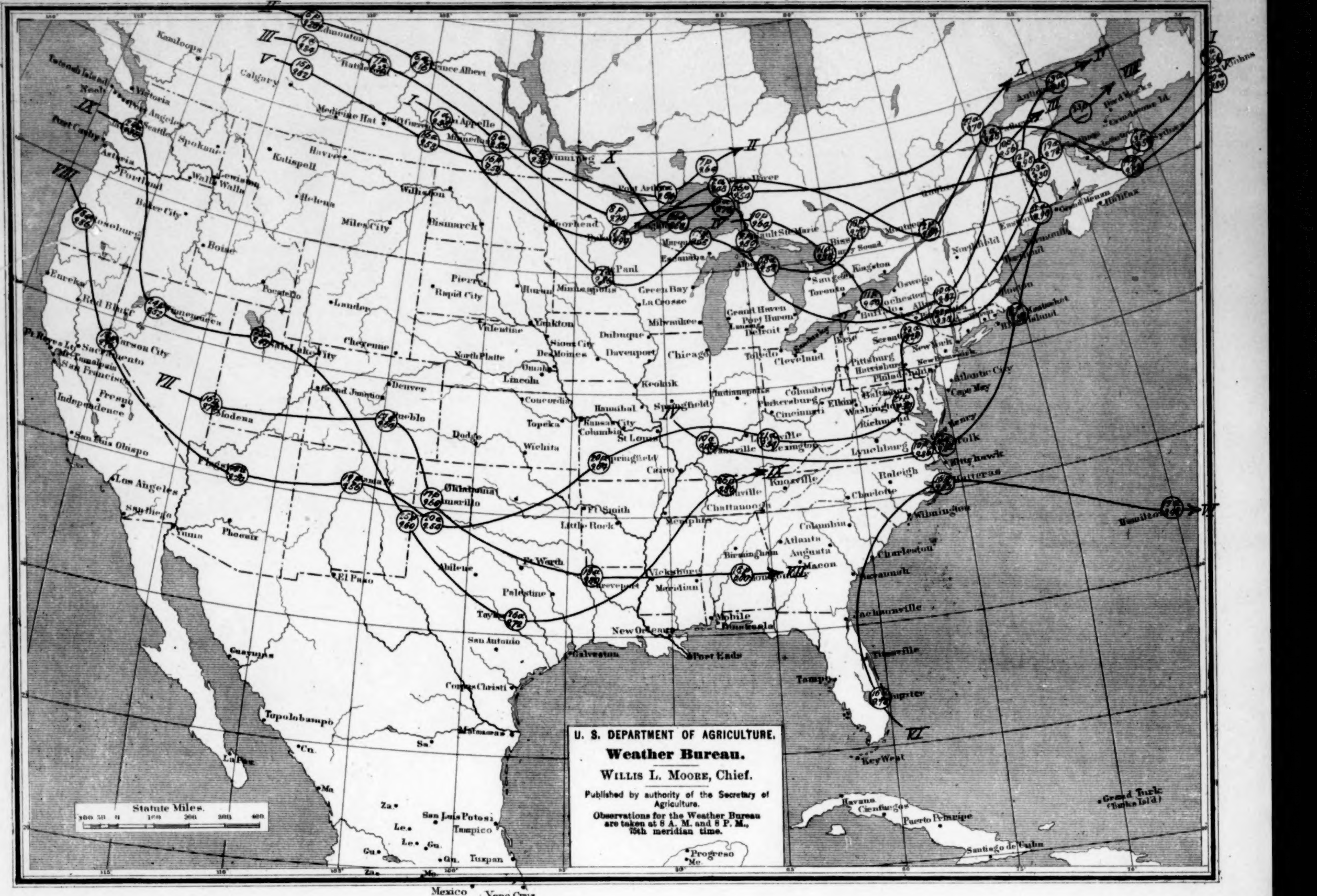

Chart III. Total Precipitation. January, 1902.

Chart IV. Sea-Level Pressure; Resultant Surface Winds. January, 1902.

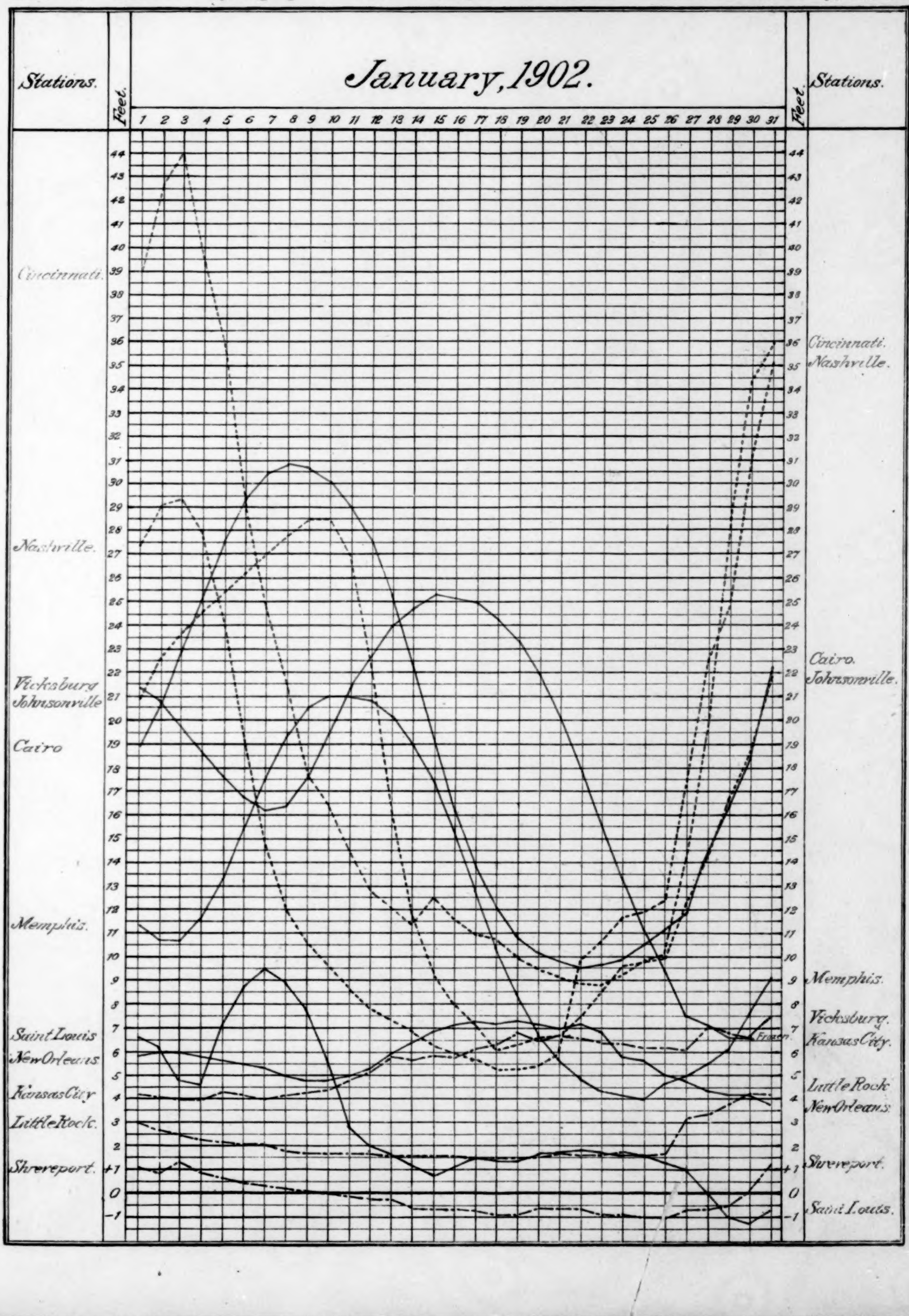
January, 1902.
Stations.
Feet.
Cincinnati.
Nashville.
Vicksburg
Johnsonville
Cairo
Memphis.
Saint Louis
New Orleans
Kansas City
Little Rock.
Shreveport.
Cairo.
Johnsonville.
Memphis.
Vicksburg.
Kansas City.
Little Rock
New Orleans.
Shreveport.
Saint Louis.
Frozen.

Chart VI. Surface Temperatures; Maximum, Minimum, and Mean. January, 1902.

Chart VII. Percentage of Sunshine. January, 1902.

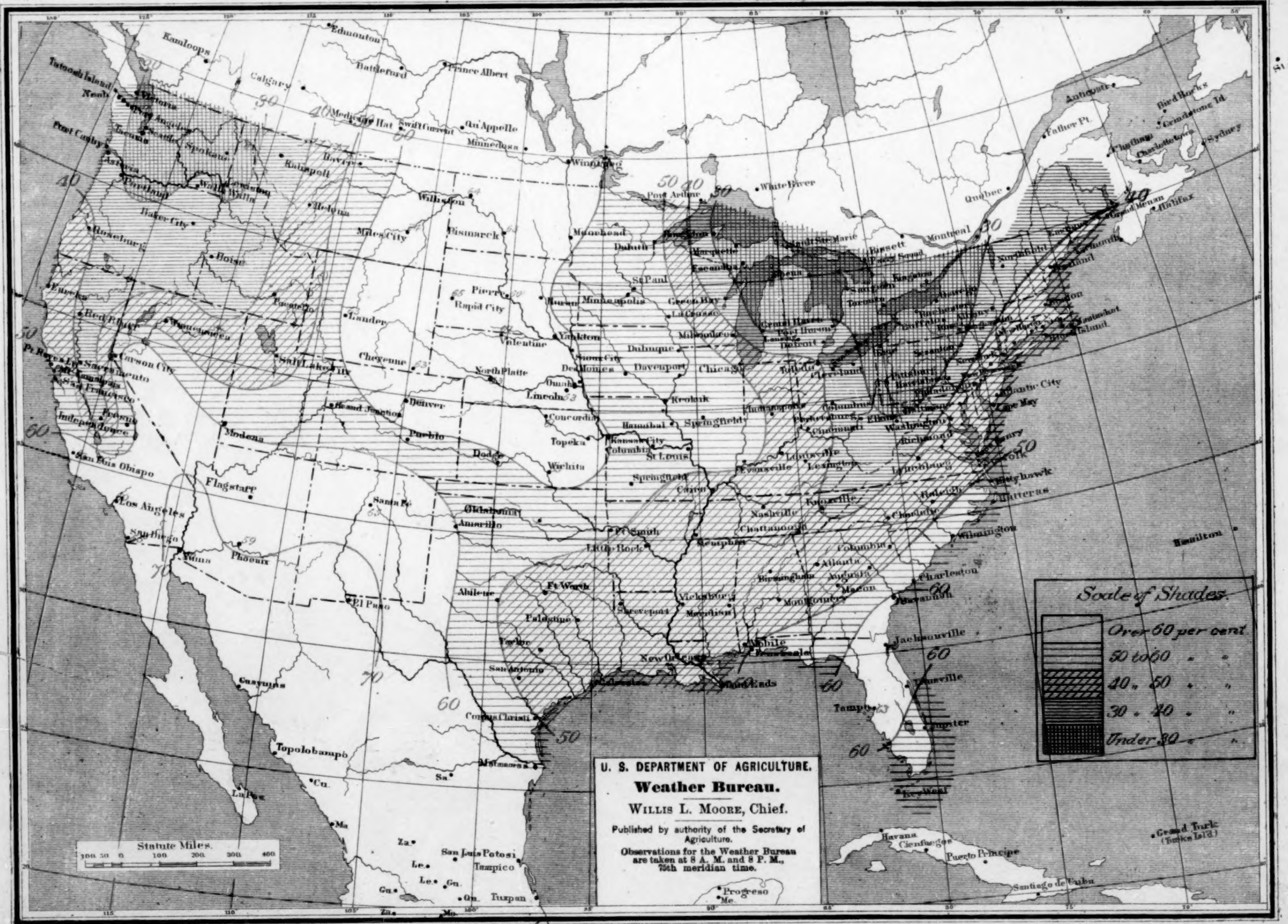

Chart VIII. West Indian Monthly Isobars, Isotherms, and Resultant Winds. January, 1902.

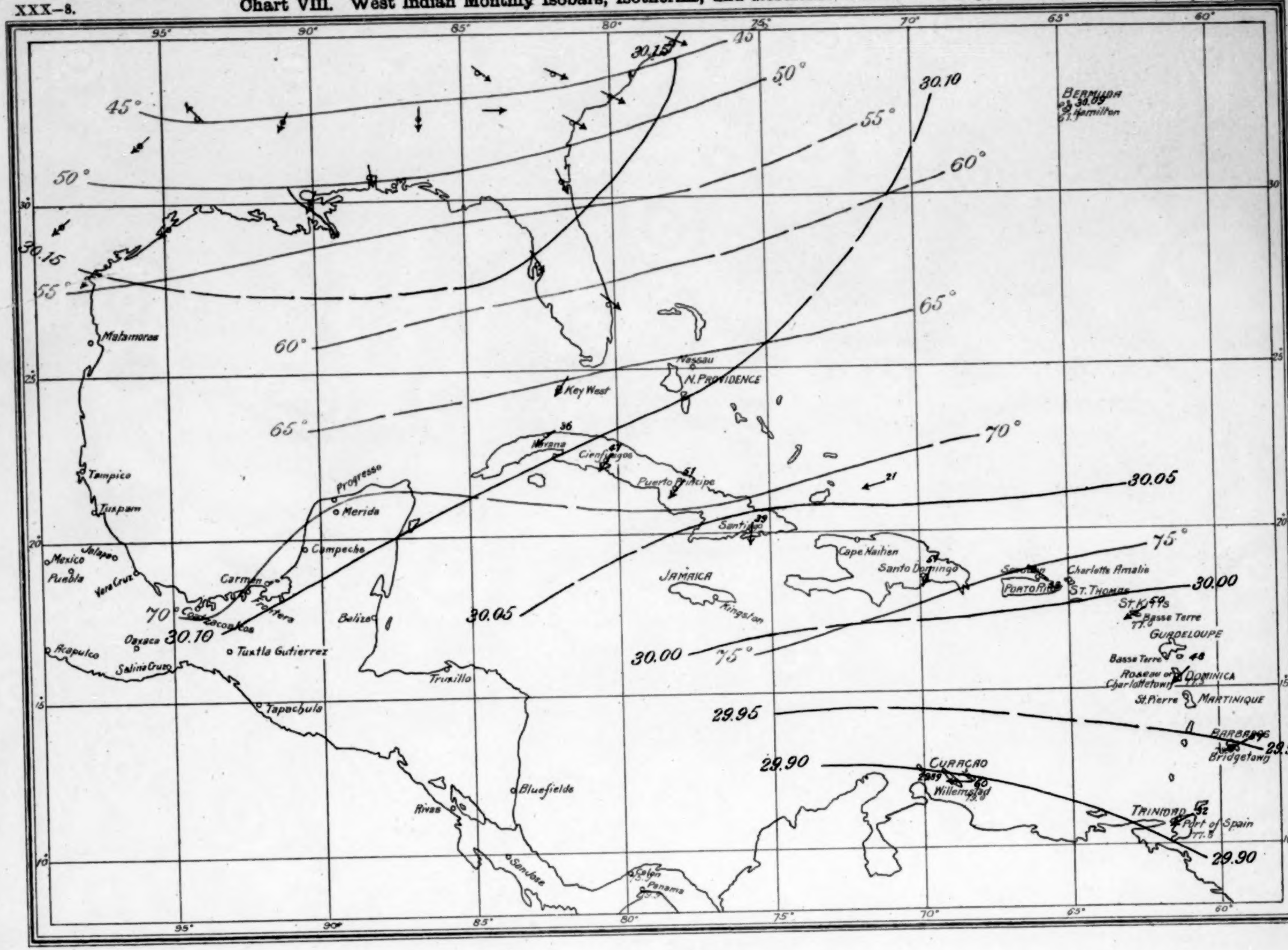

Chart IX. Total Snowfall for January, 1902.

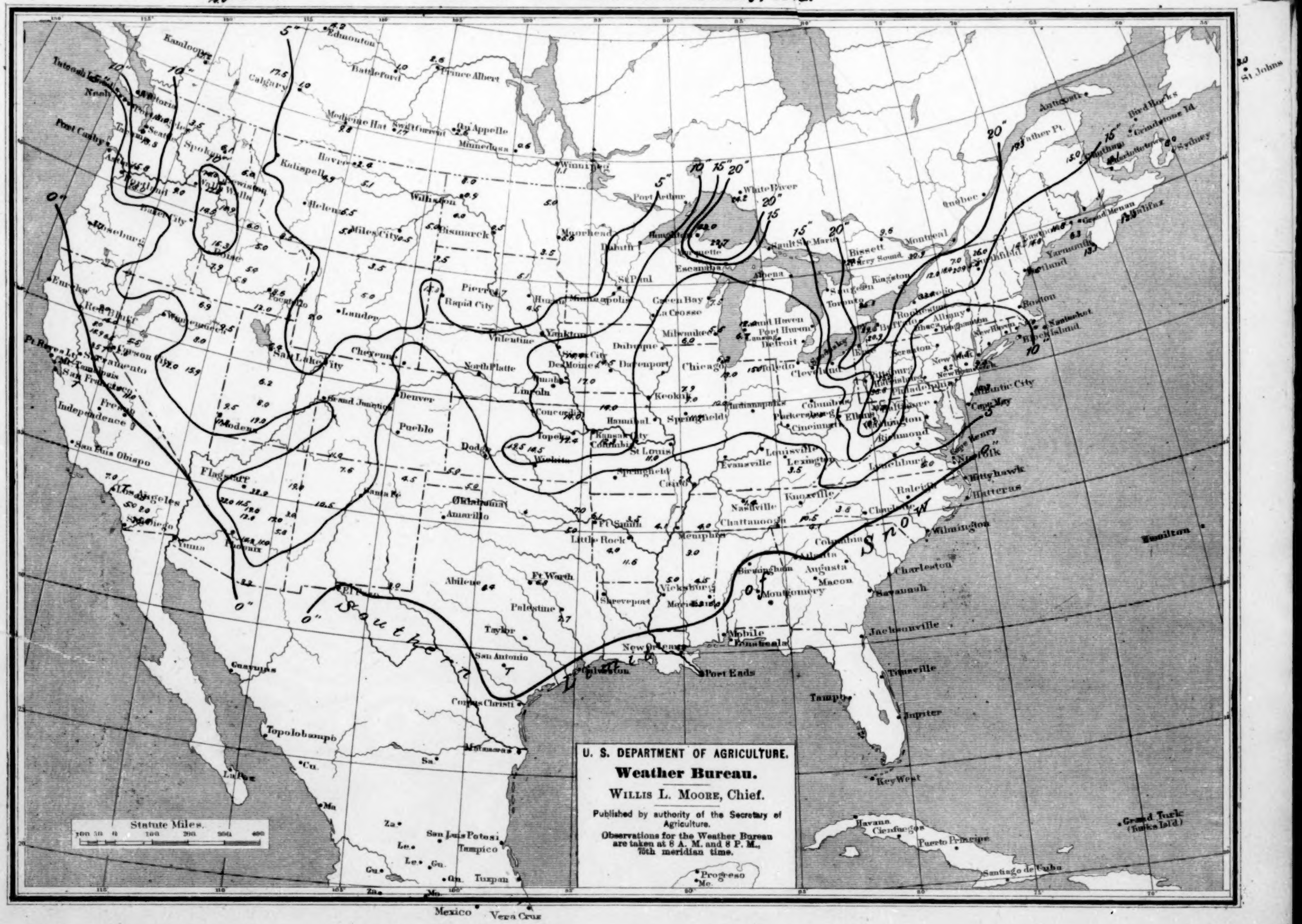

Chart X. Depth of Snow on Ground on January 31, 1902.